COUNTER / TIMER
INSTRUCTION MANUAL

SD 1292
Transfer Oscillator

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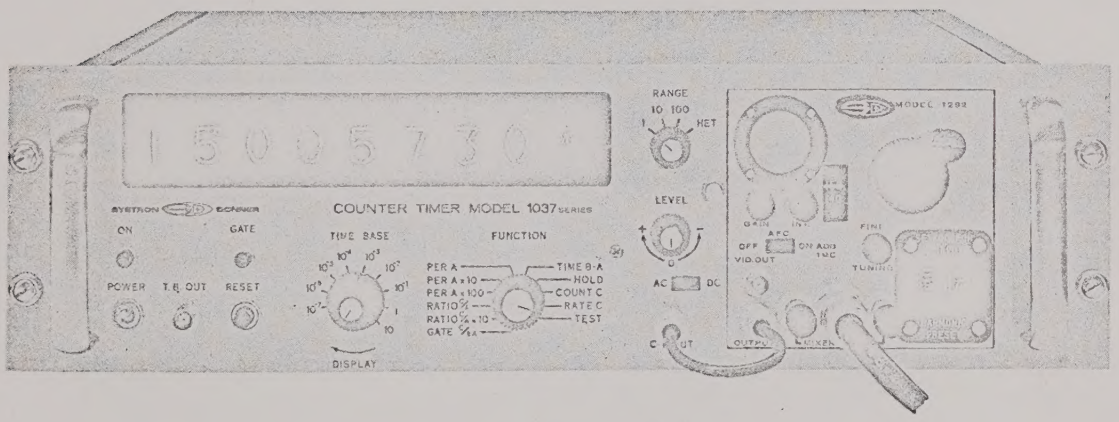
SERIAL NO.

DATE

Model 1292
Transfer Oscillator



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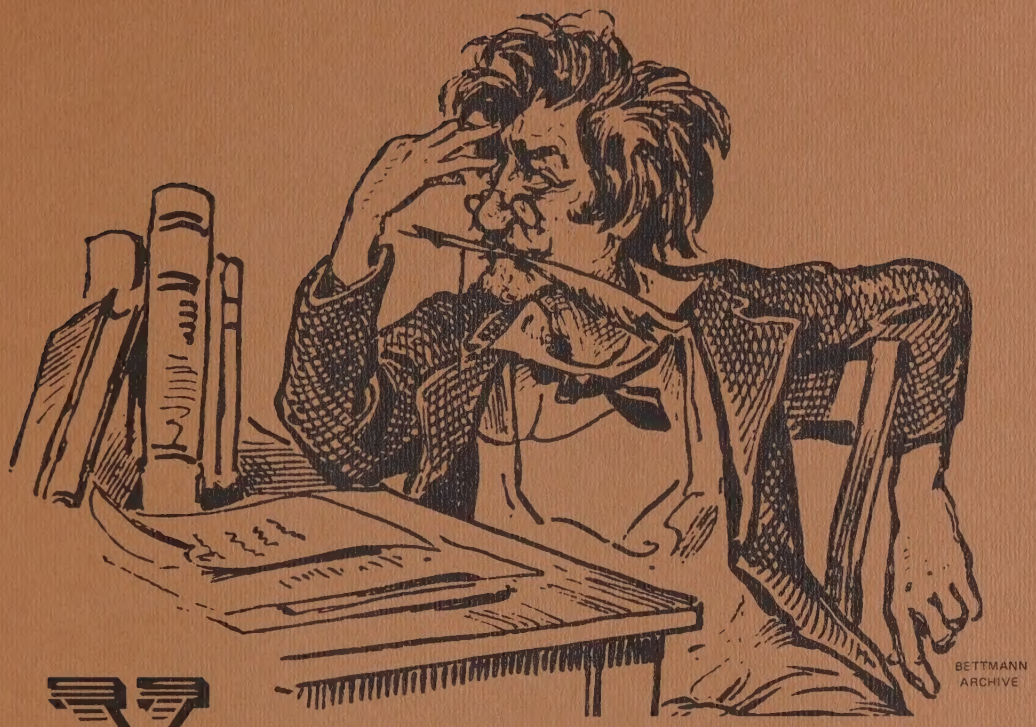

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CHANGE NOTICE

MODEL 1292 TRANSFER OSCILLATOR(S/N 639 UP)

An improved version of the 1292 Transfer Oscillator is effective with serial number 639. Basically this improvement involves an integrated-circuit harmonic preset assembly and an internal connection of the transfer oscillator output to the HET input of the counter. Later models of the model 1297 Transfer Oscillator also incorporate an integrated-circuit preset assembly with the addition of a "Hundreds" preset switch and binary.
The following corrections should be made to the basic 1292 manual to reflect this change.

A. Insert 1292/1297 Addendum dated 1/68 after last page in basic manual.

B. Make following corrections to text of basic manual:

Paragraph	Action
3-7a	Delete
3-8c	Change to read: "Set counter RANGE to HET."
4-19	Delete
4-20	Delete
4-21	Delete
4-22	Delete
4-23	Delete
4-35	Delete
4-36	Delete
5-5d	Change to read: "...and RANGE switch to HET position."
5-5e	Delete first sentence

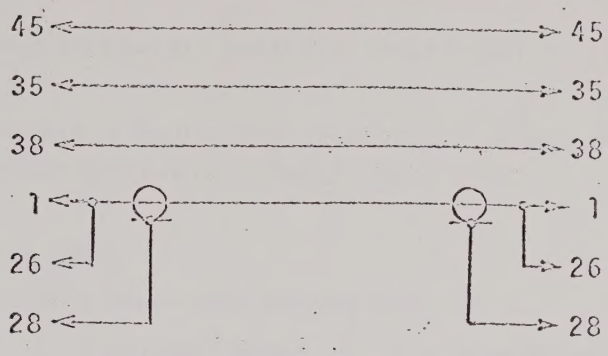
C. Make following corrections to illustrations in basic manual:

Figure	Action
Cover page	Delete OUTPUT jack on plug-in and accessory cable connecting to counter C-INPUT
3-1	Delete items 11 and 12
4-2	Delete
4-3	Delete
4-4	Delete
5-1	Delete BNC jumper cable

1.68.VJ

5-2 Add following pin-to-pin wiring:

Amphenol 57-30500 Amphenol 57-40500-2



6-2	Delete
6-5	Delete
6-6	Delete
6-7	Delete
6-8	Delete
6-4	Change R131 to 47 ohms Change R143 to 100 ohms Change Q113 to type 2N706A Change J1 to J6-1,26
6-10	Change all transistors to type 2N2222 except Q301; Q301 is type 2N706A Change R310 to 820 ohms

D. Make following corrections to tables in basic manual:

Table	Action
4-1	Delete
6-2	Change SD Part No. for Q113 to Q0183 Change SD Part No. for R131 to R0743 Change SD Part No. for R143 to R0966
6-3	Delete
6-4	Delete
6-5	Change SD Part No. for Q301 to Q0183 Change SD Part No. for Q302-Q308 to Q0116 Change SD Part No. for R310 to R0762

E. Delete drawing 1979-107-D1, Model 1297 Transfer Oscillator

OPERATING NOTES

CAUTION: Keep the monitor scope intensity at a low level to avoid burning the tube screen.

STANDBY: When making measurements in the 0 to 50 MC range at the 'C' input of the counter, leave the harmonic preset switches on the Model 1292 at "0-0".

RESOLUTION vs. MEASUREMENT TIME:

The time required to make a measurement with the Model 1292 is:

Measurement Time = 3 × Harmonic number × Time Base Setting

The Resolution of the final reading is dependent upon the time base selected on the Model 1037:

Time Base	Resolution
10 sec	± 0.1 cps
1 sec	± 1 cps
0.1 sec	± 10 cps
0.01 sec	± 100 cps
1 msec	± 1 kc
0.1 msec	± 10 kc
0.01 msec	± 100 kc

To keep the measurement time to a minimum, it is important to select the shortest time base commensurate with the required resolution. The resolution need never exceed the actual stability of the signal being measured by a factor of more than 10.

Example: Input is 10 GC (10,000,000,000 cps)

a. If stable to .01% – Need resolution .001% or 100KC or

b. If stable to 1 part in 10^7 – Need resolution of 10^8 or 100 cps

Measurement Time = a. 3 × (Harmonic Number) 100 × (Time Base) 10^{-5} = .003 second

b. 3 × 100 × 10^{-2} = 3 seconds

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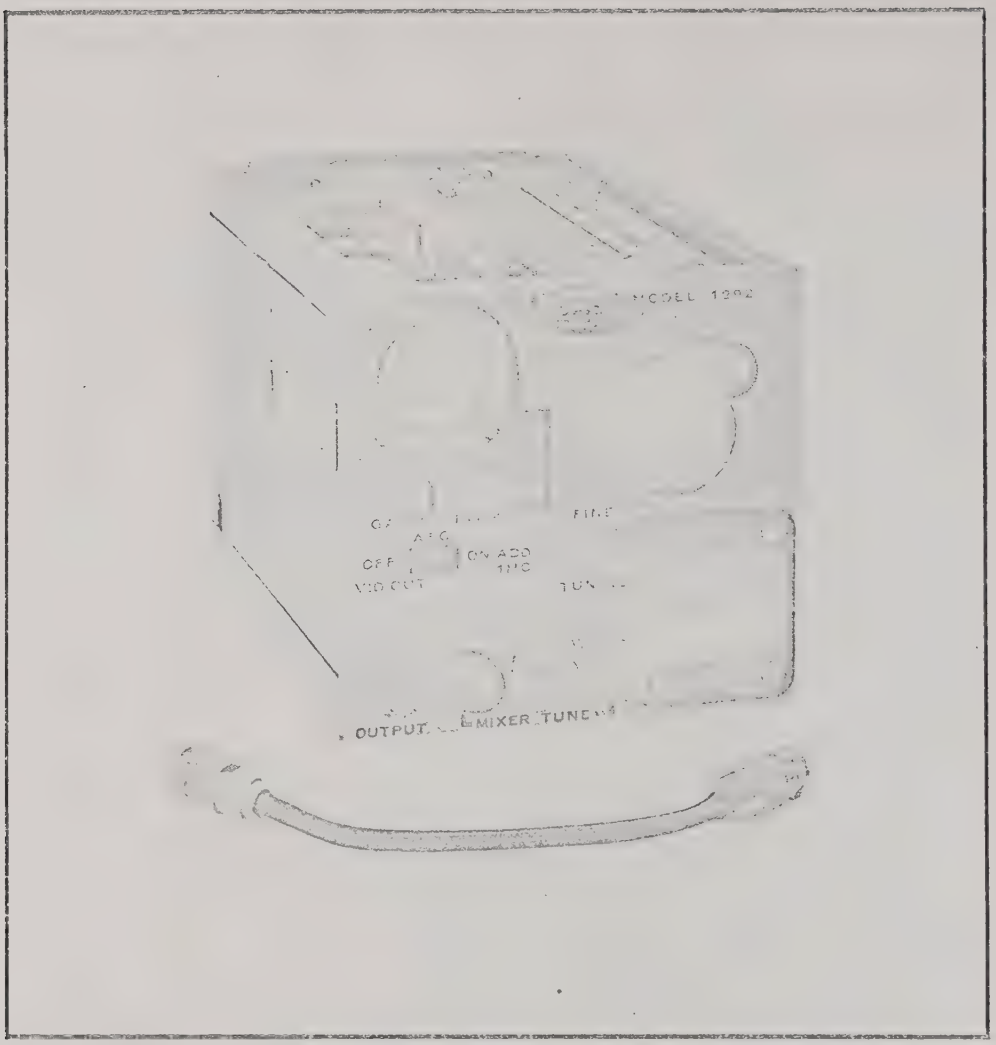


Figure 1-1 Model 1292 Transfer Oscillator

SECTION I — GENERAL DESCRIPTION

1-1 INTRODUCTION

1-2 The Model 1292 transfer oscillator plug-in is used in conjunction with the S-D Model 1037 counter to extend the frequency measurement range from 50 megacycles to 15 gigacycles per second. Measurements can be made of CW, AM, FM or pulsed RF signals. These signals may contain considerable noise levels without affecting the ease of accuracy of measurement. CW measurements can be made with the same accuracy and stability of the counter.

1-3 Counter accuracy is achieved by an automatic frequency control and phase lock feature which provides tracking of a varying input signal. Harmonic preset switches permit selection of the counter time base so that a direct indication of the input frequency signal is automatically presented on the counter. A panel monitor scope permits one to tune the transfer oscillator precisely to the input frequency by observing a zero beat frequency.

1-4 OPERATIONAL DESCRIPTION

1-5 The Transfer Oscillator generates a fundamental frequency which may be varied within the range of 50MC to 150MC. It also generates all harmonics of this fundamental up to the 100th.

1-6 To measure the frequency of an input signal, the fundamental is adjusted to the point where one of its harmonics has the same frequency as the input signal. This is done by beating the harmonic against the input signal and varying its frequency until the difference frequency observed on a built-in oscilloscope is zero. Then a frequency equal to the fundamental frequency is indicated on the 50MC Counter. If the counter counted each cycle of this signal for .01, .1 or 1 second, the fundamental frequency would be displayed. To find the input frequency then we would multiply this indication by the harmonic number (N). To avoid this calculation, the counting period is expanded to N times the usual counting period with the result that the input frequency appears directly in decimal digits on the face of the counter. In the "AFC" mode a combination of AFC and Phase Lock is used to synchronize the transfer oscillator with the input signal. Any tendency toward frequency change in either the input signal or the transfer oscillator is immediately compensated for by changing the transfer oscillator frequency to maintain a precise one megacycle beat frequency with the input signal. This can be observed on the self-contained oscilloscope as a 1:1 Lissajous pattern.

Table 1-1 Model 1292 Transfer Oscillator Plug-In Specifications

Frequency Range	50 Mc to 15 Gc
Type of Input Signals	Continuous fixed frequency signals with or without amplitude modulation. FM signals. Pulsed RF signals.
Signal Input Sensitivity	Better than 100 mv rms,(−7 dbm to +10 dbm) 50 Mc to 12.4 Gc Typically −12 to −40 dbm .5 to 10 Gc, usable to 15 Gc
Maximum Level	1.99 volts or +18 dbm (79.4 mw)
Impedance	50 ohms nominal
Accuracy	± stability ± resolution of measurements of Transfer Oscillator fundamental. Stability: same as 1 Mc reference from 50 Mc Counter in AFC mode. Resolution: ±1 count (Model 1037 Counter).
AFC Lock on Range	±0.25% of input frequency
Phase Lock on Range	±0.01% of input frequency

Controls: Fundamental Signal Dial	50 Mc to 150 Mc
Harmonic Preset	1 to 99
Zero Beat Indicator	Self-contained oscilloscope
AFC Switch	"On-Off" control
Vernier Control	For fine tuning
Video Output	For external scope, 0.5 v peak-to-peak.
Power	From Model 1037 50 Mc Counter 16.5 w
Environmental Conditions Ambient Temperature	0 to 55°C
Physical Parameters Dimensions	Standard plug-in
Weight	7 lbs.

1-7 SENSITIVITY

1-8 The required signal level varies with frequency typically as shown in Figure 1-2. A minimum usable signal level will produce a S/N Ratio of 6 db at the Video Amplifier output. This represents the signal necessary to produce a usable vertical deflection of the internal oscilloscope. The Model 1292 contains a broadband two-stub tunable mixer which provides a means of obtaining the best sensitivity at a given frequency so that low level signals may be measured. The efficiency of the mixer falls off as higher frequencies are measured with the resultant loss in sensitivity. A similar loss of efficiency and sensitivity occurs as lower frequencies are measured. This results in the curve shown in Figure 1-2 which is on the order of 7 to 70 millivolts rms (-30 to-10 dbm) from 0.5 to 10 GC and better than 100 millivolts rms (-7 dbm) from 50 to 500MC and 10 to 12.4 GC.

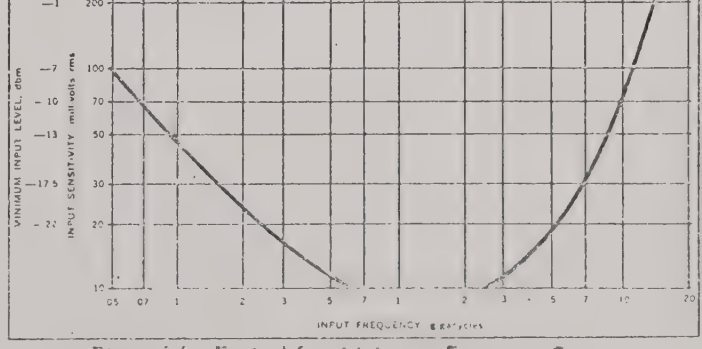


Figure 1-2 Typical Sensitivity vs. Frequency Curve

1-9 ACCURACY

1-10 Measurements made with the Transfer Oscillator are subject to sources of error as indicated in the following paragraphs.

1-11 CW MEASUREMENTS

1-12 The possible error involved in measuring a CW frequency can be divided into two parts. First is the error of the frequency counter in measuring the transfer oscillator frequency which is ± stability ± 1 count. Stability of the S-D Model 1037B is better than 1 part in 10^9 per day. With the ± 1 count error reduced to less than ± 1 part in 10^9 by selecting an appropriate time base, CW signals over 1 GC can be measured with counter error reduced to less than ± 2 parts in 10^9. The second part of the possible error involves comparing the transfer oscillator frequency and/or harmonics with the frequency to be measured. In the "AFC - On" mode, this error can be reduced to virtually zero with the transfer oscillator locked to a stable input signal. When using the transfer oscillator with the "AFC - Off" this error is on the order of ± 1 part in 10^7 due to the drift of the transfer oscillator during the measurement plus a possible ± 1 part in 10^7 error depending on operator skill. Both of these errors are essentially eliminated in the AFC mode and thus the accuracy achieved is as good as the accuracy of the basic counter.

1-13 FM MEASUREMENTS

1-14 When measuring the center frequency of a frequency modulated signal, error is introduced by several sources. In addition to the accuracy of the counter measuring the fundamental transfer oscillator frequency (± 1 count, ± stability), there is the amount of deviation of the harmonic frequency from a precise zero beat with the input signal and the short term drift (during measurement) of the fundamental transfer oscillator frequency. A fine tuning control on the transfer oscillator permits measurements with a precision approaching ± 10KC to be achieved in tuning to the zero beat. The drift of the transfer oscillator during a one second measurement time is on the order of ± 1 part in 10^7.

1-15 PULSED RF MEASUREMENTS

1-16 The accuracy with which pulsed RF measurement can be made depends on the same sources of error present in FM signal measurements. The harmonic frequency deviation from a precise zero beat with the input signal can be reduced to the order of 0.01 cycles per pulse width. The drift of the transfer oscillator can usually be neglected since most pulsed RF measurements will have a pulse width less than 100 μ seconds.

SECTION II — INSTALLATION

2-1 INITIAL INSPECTION

2-2 As soon as the plug-in is received, verify that the instrument is intact and as ordered. Inspect the plug-in for any physical damage such as scratched panel, broken knob, or bent connectors. If damage is found, refer to the warranty (inward-side of rear cover) and Paragraph 2-5 for shipping and repackaging instructions. Perform acceptance tests cited in paragraph 5-3, Section V of this manual.

2-3 STORAGE AND RESHIPMENT

2-4 Environmental conditions during storage and shipment should be limited as follows:

a. Maximum temperature 167° F (75° C)

b. Minimum temperature −40° F (−40° C)

2-5 To protect your instrument during shipment or storage, use the best packaging methods available. Your Systron-Donner field office can provide materials similar to those used for original factory packaging. Contract packaging companies can provide dependable custom packaging on short notice.

a. If possible, use the original container designed for the instrument. Otherwise, use a strong carton (350 lb/sq inch bursting strength) or wooden box to house the instrument.

b. Wrap the instrument in heavy paper or plastic before placing it in the shipping container.

c. Use plenty of packing material around all sides of the instrument and protect the front panel with cardboard strips

d. Seal the package with strong tape or metal bands. Mark with "Delicate Instrument."

e. Refer to the warranty page at the front of this manual and check with your Systron-Donner field office for shipping instructions. All correspondence should refer to an instrument by model number and the full, serial number.

2-6 INSTALLATION

2-7 To install the plug-in in the compartment provided at the right side of the counter front panel, proceed as follows:

a. Remove AC power from the counter.

b. Loosen locking screw on left side of the plug-in compartment by turning approximately one turn counterclockwise.

c. Remove blank filler panel or plug-in unit installed.

d. Slide the plug-in into the compartment. Make certain the plug-in is properly aligned and tighten the locking screw.

2-8 COOLING

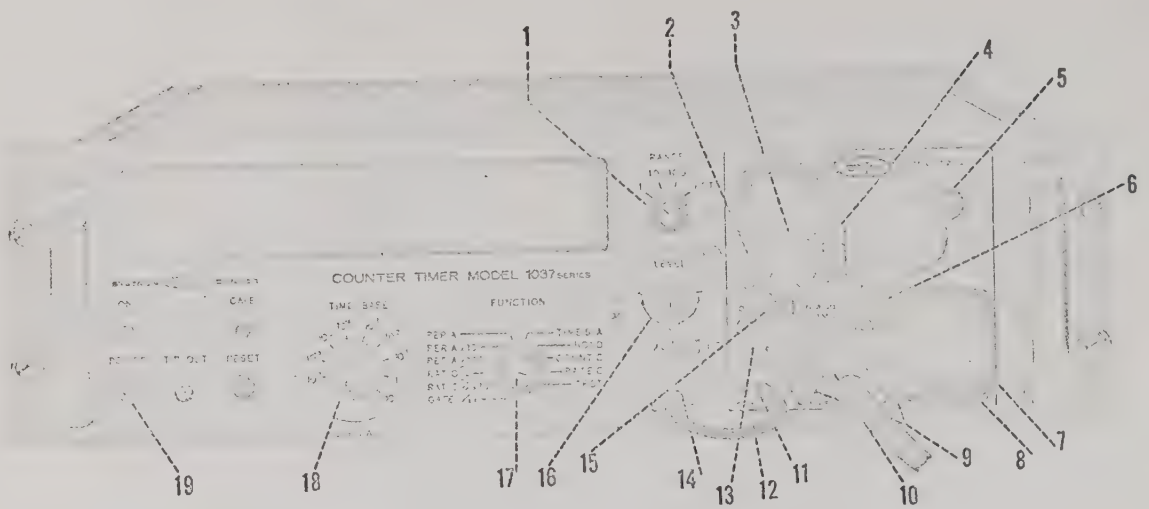
2-9 The plug-in unit is cooled by the ventilation of the counter in which it is installed. Refer to the Operating and Service Manual of the Counter for cooling system maintenance instructions.

2-10 POWER REQUIREMENTS

2-11 All voltages required to operate the plug-in are supplied by the circuits of the counter in which the plug-in is installed.

2-12 ELECTRICAL CONNECTIONS

2-13 The INPUT jack on the front panel of the plug-in provides the only connection for the input signal. The front panel VID OUTPUT connector supplies the plug-in output for monitoring by external equipment. The plug-in OUTPUT jack must be connected to the counter C INPUT jack.



1. Range Selector – Selects an attenuation factor of X1, 10 or 100.
2. Gain Control – Used to adjust amplitude of oscilloscope waveforms.
3. Intensity Control – Used to adjust brightness of waveform on built-in scope.
4. Oscillator Fundamental Frequency Indicator – Indicates fundamental frequency of plug-in oscillator in 10 MC increments between 50 and 150 MC.
5. Oscillator Rough Tuning Control – Main tuning control with a range of 50 Mc to 150 Mc. Start at high end of dial and adjust downward to obtain a zero beat of harmonic.
6. Oscillator Fine Tuning Control – The vernier control of the main oscillator tuning control; used for precise adjustment of zero beat.
7. Divide by Three Harmonic Preset Switch – Multiplies time base by 3.
8. Divide by Thirty Harmonic Preset Switch – Multiplies time base by 30.
9. Tuning Stubs – Tuning adjustment for mixer plug-in.
10. Plug-in Input Signal Jack – Mates with UG-160/BU connector.
11. Plug-in Output Jack – Mates with BNC type UG 260 M/U connector.
12. Plug-in Accessory Cable – Mates plug-in output to counter.
13. Video Output Jack – For use with an external scope to display the zero beat. Used primarily in applications requiring greater bandwidth and/or sensitivity than provided by built-in scope.
14. C Input – Counter inputs mates with BNC type UG 260 A/U connector.
15. AFC Control – Used to lock transfer oscillator to input frequency to achieve a precise 1 Mc beat during CW measurements.
16. Trigger Control – Used to select the DC voltage level which will produce consistent triggering of the counting circuitry.
17. Function Selector Switch – Selects counter function to be used. When using 1292 Oscillator switch will be in RATE position. In RATE position, switch enables the counting of the number of events (frequency) which occur within a unit of time selected by Time Base switch.
18. Time Base Switch – Selects time base output frequencies used as time reference.
19. Power Switch – AC line switch.

Figure 3-1 Front Panel Controls and Connectors

SECTION III — OPERATION

3-1 INTRODUCTION

3-2 This section contains the operating procedures and operational techniques employed when using the Model 1292 Transfer Oscillator in conjunction with the Model 1037 Frequency Counter.

3-3 FUNCTIONS OF CONTROLS & CONNECTIONS

3-4 Figure 3-0 indicates the locations and functions of the transfer oscillator controls and connections.

3-5 PRE-OPERATION

3-6 Perform the procedures of paragraphs 3-7 and 3-8 prior to measuring frequencies with the transfer oscillator.

3-7 CONNECTIONS

a. Connect accessory cable between counter C INPUT jack and transfer oscillator OUTPUT jack.
b. If measuring FM frequencies modulated other than 60 or 120 cps, or pulsed RF signals, connect an external oscilloscope to oscillator front panel VID OUT jack.
c. Connect signal cable to front panel input jack.

C A U T I O N

The mixer can saturate at approximately +10 dbm. In this condition no beats will be obtained with CW signals. This condition can also damage the transfer oscillator diodes. Attenuate input signals to within sensitivity range indicated in Figure 1-2, Section I, of this manual.

3-8 CONTROL SETTINGS

a. Place counter rear panel INTERNAL-EXTERNAL switch in INTERNAL position.
b. Place counter POWER switch in ON position.
c. Set counter RANGE switch to A. HET
d. Set counter TIME BASE switch to 10^{-4}.

NOTE

See Paragraph 3-17 Resolution Vs. Time Measurement.

e. Adjust counter trigger level as follows:
   (1) Set function switch to COUNT.
   (2) Turn LEVEL control until counter starts to count.
   (3) Continue turning LEVEL control until counter ceases to count.
   (4) "Back-off" LEVEL control to mid-point between the "start count" and "stop count" limits.
f. Set counter FUNCTION switch to RATE.
g. Place Transfer Oscillator AFC switch in OFF position.
h. Turn Transfer Oscillator GAIN control to maximum (clockwise).
i. Set Transfer Oscillator HARMONIC PRESET switches to 01.

3-9 FREQUENCY MEASUREMENT WHEN FREQUENCY IS KNOWN WITHIN ± 100 MC

3-10 The following method is usually most satisfactory when the frequency to be measured is known to within ±100 MC.

C A U T I O N

To avoid burning the tube screen, keep the monitor scope intensity at a low level.

a. Find zero beat by starting at highest fundamental frequency of oscillator (150 MC) and turn oscillator fundamental frequency control downward. The vertical amplitude of the zero beat should be ½" minimum.

NOTE

Typical zero beat and near zero beat display patterns are shown in paragraph 3-26.

b. If measuring input signals with low input voltage, adjust oscillator mixer tuning stubs for maximum deflection in accordance with paragraph 3-15.
c. With Counter Display Time control set at minimum, observe counter readout. Readout should be equivalent to fundamental frequency of oscillator.
d. Increase Harmonic Preset numbers incrementally until counter readout indicates known frequency ±100 MC; i.e., if frequency is known to be 9.6 Gc ±100 MC, readout should be 9.6 Gc ±100 MC.

3-11 ANSWER VERIFICATION

3-12 To verify answer:
a. Tune to next higher zero beat.
b. Set Harmonic PRESET switches to next lower number.

Notice that the harmonic preset number above and below the correct answer will be in error by approximately 150 MC (the fundamental frequency of the transfer oscillator).

NOTE

If the verification answer on the next higher zero beat is greater than the original measurement, the harmonic number selected was to high in both measurements.

3-13 FREQUENCY MEASUREMENT WHEN FREQUENCY IS UNKNOWN

3-14 Proceed as follows when measuring an unknown frequency.
a. Perform steps a and b of Paragraph 3-9.
b. Read transfer oscillator frequency at zero beat on counter and record five most significant digits (f_H) i.e., 14788.
c. Move transfer oscillator to next lower zero beat and record five most significant digits (f_L) i.e., 14564.
d. Subtract f_L from f_H (14788—14564 = 224).
e. Divide difference into higher frequency (f_H) (slide rule accuracy) to get whole number harmonic of lower frequency (f_L). 14788 ÷ 224 = 66.
f. Set Harmonic switches to quotient (66) with zero beat (f_L) still on scope and readout answer directly on counter "9612565.1KC". See paragraph 3-22 for a critique of settling the harmonic number.
g. Verify answer in accordance with method of para. 3-11.

3-15 MIXER TUNING AND GAIN ADJUSTMENT

3-16 For Low Input Voltage signals at or below the typical sensitivity curve (Figure 1-2, Section I) adjustment of the tuning stubs may be required.
a. Tune for maximum amplitude of zero beat.
b. After mixer is tuned (if required) the GAIN control should be adjusted so that a zero beat causes a vertical indication of approximately ½ to ¾ inches.

3-17 RESOLUTION VS. TIME MEASUREMENT

3-18 The time required to make a measurement with the Model 1292 is expressed as: Measurement Time = 3 × Harmonic Number × Time Base Setting.

The Resolution of the final reading is dependent upon the time base selected on the Model 1037, and is in accordance with the following table.

Table 3-1 Time Base vs. Resolution

TIME BASE	RESOLUTION
10 sec	± 0.1 cps
1 sec	± 1 cps
0.1 sec	± 10 cps
0.01 sec	± 100 cps
1 msec	± 1 kc
0.1 msec	± 10 kc
0.01 msec	± 100 kc

3-19 To keep the measurement time to a minimum, it is important to select the shortest time base commensurate with the required resolution. The resolution need never exceed the actual stability of the signal being measured by a factor of more than 10.

Example: Input is 10 GC (10,000,000,000 cps)

a. If stable to .01% - Need resolution .001% or 100KC

or b. If stable to 1 part in 10^7 — Need resolution of 10^8 or 100 cps.

3-20 PRECISE CW MEASUREMENT WITH AFC PHASE LOCK

3-21 If a highly precise reading is required (to counter accuracy), the "AFC" mode of operation can be used after normal measurements. In the AFC mode, the transfer oscillator is locked to the input frequency such that a precise 1 MC beat is achieved. A 1:1 Lissajous pattern on the self-contained oscilloscope permits the operator to achieve a precise 1 MC offset. This pattern is shown in Figure 3-2. The 1 MC offset is accounted for by adding 1 MC to the reading displayed on the counter.

a. Place AFC switch in ON position.
b. Perform paragraph 3-9 if measuring known signal or paragraphs 3-13 if measuring unknown signal.
c. Tune for 1:1 Lissajous pattern as shown in Figure 3-2.
d. Observe counter readout.
e. Mentally add 1 MC to counter readout.

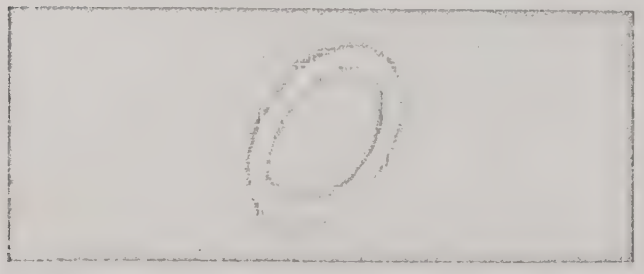


Figure 3-2 Typical 1:1 Lissajous Pattern

3-22 SETTING THE HARMONIC NUMBER

3-23 When the zero beat is obtained, the frequency being measured will be equal to the frequency of the transfer oscillator multiplied by the harmonic causing the beat. The proper harmonic number can usually be set into the two digit harmonic preset switch at once, because the approximate value of the frequency being measured is usually known to 1 or 2 percent. Even if the approximate value is completely unknown, the harmonic number can still be obtained easily by making two short measurements (See paragraph 3-13). For example, if a known frequency of approximately 9 GC were to be measured, the transfer oscillator could be tuned to 150 MC (f_H) where the zero beat would be caused by the 60th harmonic. The counter will then readout 90000000 or any eight digits of the measured frequency depending on the setting of the time base switch on the counter. The answer should be verified by now setting the transfer oscillator to the next lower frequency that causes a zero beat. We know that the next lower zero beat must be caused by the next higher harmonic. In the example mentioned, this zero beat would occur when the transfer oscillator is tuned to 147.54 MC. With the harmonic preset switch set to 61 (60 + 1), the answer is verified on the counter.

3-24 Calculation is not usually made since if the reading checks higher at f_H than the reading at f_L then N is set too high and should be reduced so that the reading is verified.

Mathematically this can be expressed by the equation —

$$F_{IN} = Nf_H = (N + 1)f_L$$

Where: F_{IN} = the input frequency

f_H = the higher fundamental frequency whose Nth harmonic causes a zero beat with the input frequency.

N = the harmonic number of the higher fundamental frequency (f_H)

f_L = the next lower fundamental frequency that will have a harmonic (N + 1) causing a zero beat with the input frequency . . . or

to substitute the values used in the example above we have 9 GC = 60 × 150 MC = 61 × 147.54 MC.

3-25 To find the harmonic number the equation can be solved for N as follows:

$$Nf_H = (N \times 1) f_L$$
$$Nf_H = Nf_L + f_L$$
$$Nf_H - Nf_L = f_L$$
$$N(f_H - f_L) = f_L$$
$$N = \frac{f_L}{f_H - f_L}$$

3-26 ZERO BEAT DISPLAYS

3-27 The following paragraphs indicate the oscilloscope displays an operator may expect to see when performing measurements with the Model 1292 Transfer Oscillator. A short critique of the techniques involved while tuning is also included.

3-28 CW MEASUREMENTS

3-29 To measure a CW frequency signal, the transfer oscillator is tuned while observing the difference frequency on the self-contained oscilloscope. As the zero beat frequency is approached, the pattern will be similar to Figure 3-3.

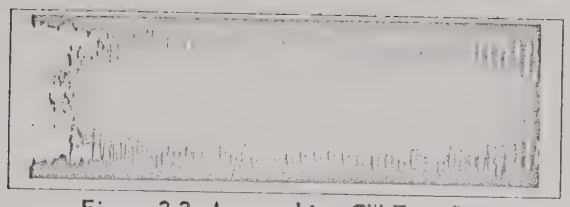


Figure 3-3 Approaching CW Zero Beat

3-30 As the transfer oscillator is fine tuned, the pattern will approach a horizontal line as shown successively in Figure 3-4 and 3-5, if a perfect zero beat can be obtained.

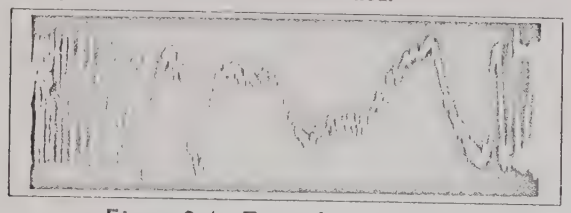


Figure 3-4 Typical CW Zero Beat

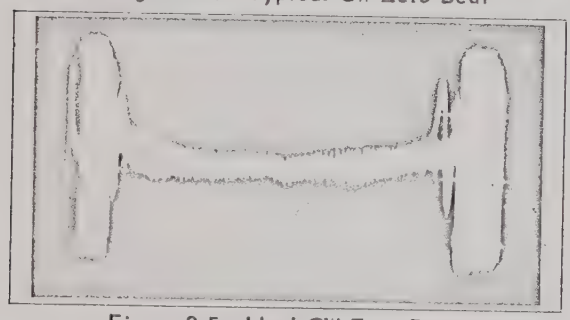


Figure 3-5 Ideal CW Zero Beat

3-31 In actual practice, few input signals will be stable enough so that a simple zero beat can be obtained. Most input signals will have enough short term instability so that the best obtainable zero beat will more closely resemble Figure 3-4. In the AFC mode, the transfer oscillator can be locked to the input signal and the measurement made. This will result in a reading which will be an average frequency over the measuring period.

3-32 Short term instability can often be treated as FM where it is desirable to know the limits of frequency excursion of a varying input signal. This can easily be done by adjusting the transfer oscillator so that the zero beat is positioned at the two edges of the pattern (Figure 3-6).

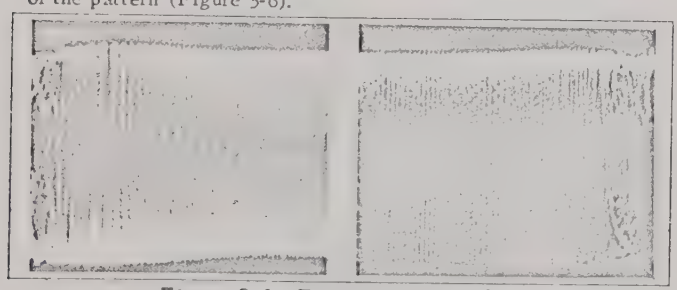


Figure 3-6 Zero Beat Positioning

The frequencies measured at these two zero beats are the limits between which the signal is varying.

3-33 FM MEASUREMENTS

3-34 Signals which are frequency modulated at 60 or 120 cps can be measured using the built-in oscilloscope. For frequencies modulated at frequencies other than 60 or 120 cps, the video output signal from the front panel connector on the transfer oscillator may be displayed on an external scope swept by the modulation signal.

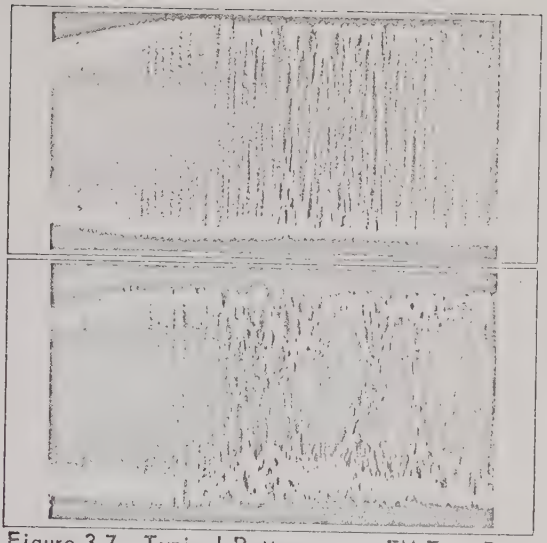


Figure 3-7 Typical Patterns near FM Zero Beat

3-35 The oscilloscope patterns at zero beat will be similar to Figure 3-7. The input frequency will pass through zero beat twice during each sweep cycle. These points appear as regions of minimum frequency in the oscilloscope pattern.

3-36 The frequency deviation of the signal can be measured by varying the transfer oscillator frequency until the zero beat appears first at one end and then the other end of the sweep span as shown in Figure 3-6. The frequency deviation will then be the difference between the indicated frequency at each extreme. The center frequency will be that indicated with the zero beat point at the middle of the sweep.

3-37 PULSED RF MEASUREMENTS

3-38 The carrier frequency of pulses as short as one microsecond can be measured using an external oscilloscope. The output of the mixer is amplified and brought out at the Video Out jack on the front panel. This signal can be coupled to the vertical input of an external oscilloscope. The sweep must be synchronized with the pulse rate.

3-39 As the transfer oscillator is tuned near a zero beat, the pattern on the oscilloscope will be similar to Figure 3-8. When the transfer oscillator is fine tuned, a pattern similar to Figure 3-9. will be observed at the point of zero beat.

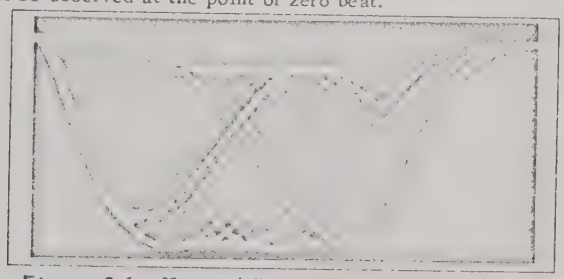


Figure 3-8 Typical Pattern near RF Zero Beat

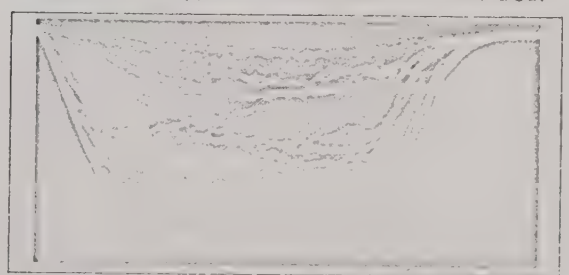


Figure 3-9 Typical Pattern at RF Zero Beat

SECTION IV — CIRCUIT DESCRIPTION

4-1 GENERAL

4-2 The system is described in the Block Diagram, Figure 4-1. The VFO generates a stable signal, adjustable in frequency from 50MC to 150MC which is divided by three and then measured by the 50MC counter. Harmonics of the VFO are then compared in a tuner mixer with the frequency to be measured. The difference frequency is adjusted to a zero beat using the built-in oscilloscope in the plug-in. By appropriate adjustment of the transfer oscillator, a zero beat can be obtained between a transfer oscillator fundamental or harmonic and any unknown frequency from 50MC to 15GC. When the zero beat is obtained, the harmonic number is set into the preset switches and this automatically selects the time base so that a direct indication is presented on the counter. Where accuracy of better than 1 part in 10^8 is desired or where it is necessary to track a varying input signal, an AFC control is provided. The AFC locks the transfer oscillator to the input signal and maintains a one megacycle offset. With this technique, measurement accuracy is that of the basic counter, typically 1 part in 10^9 with the S-D Model 1037B.

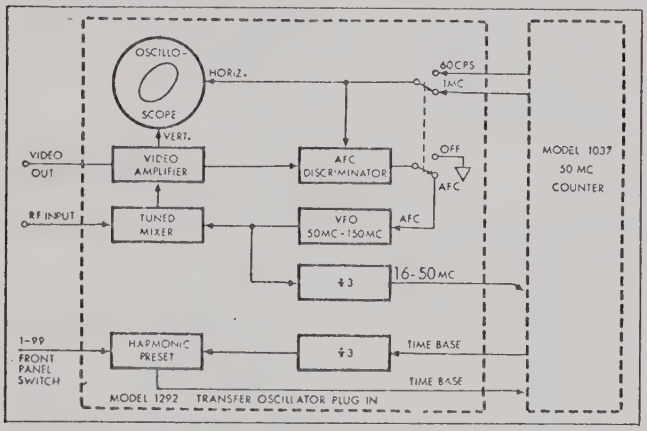


Figure 4-1 Transfer Oscillator Simplified Block Diagram

4-3 AFC – PHASE LOCK

4-4 The AFC circuit used differs slightly from an ordinary frequency control loop system. The one megacycle standard from the counter is used for both the indication of lock in the display pattern and to produce a phase locked action.

4-5 The combined one megacycle standard and the beat frequency at the amplifier are sampled by the frequency discriminator. The derived signal is a function of the shift from the one megacycle discriminator center frequency. This discriminator output level is then fed back to control the frequency of the oscillator. The oscillator is frequency controlled by a variable reactance diode arrangement in the oscillator tuned circuit.

4-6 When the system is frequency locked, the control signal will assist the operation of fine tuning the oscillator to a phase locked condition. At this point, the discriminator becomes a phase detector and its output will be a varying voltage proportioned to the difference in the phase between the beat frequency and the standard.

4-7 In a typical phase locked loop, the rate of change of the input signal frequency must be slow enough to remain within the bandwidth of the loop.

The combined AFC-phase locked loop used in the system described, allows an excursion in frequency governed by the bandwith of the crystal discriminator. The discriminator performs a dual function and adds versatility to the instrument. Over the discriminator bandwith, oscillator tuning is broad due to the gain of the AFC loop. As the offset frequency is varied by tuning to within a few cycles of the one megacycle frequency standard, the discriminator performs a mixing function. The output is a control signal and is a product of the phase difference of the two signals.

4-8 Automatic frequency control facilitates tuning by reducing the fine tuning required. The control feature is especially valuable in that with lock achieved the oscillator will follow drifts in the frequency of the incoming signal. Conversely, it will hold a locked condition despite variations of internal components. Frequency control of a shift in signal frequency is possible as long as the carrier frequency remains within the linear range of the discriminator response. The AFC of an FM signal is possible when deviation is small and modulation rate is low. AFC control is possible with high modulation rates and deviation, provided the modulation index is chosen to retain sufficient power at the carrier for discriminator action. Figure 4-1 illustrates a frequency control arrangement where the transfer oscillator is locked to the input frequency so that a one megacycle beat is achieved. A crystal discriminator is used to sample the offset frequency and provide control to one side band only. To insure precision of the offset and phase lock condition, the beat is compared with the one megacycle derived from the counter time base standard. The resulting 1:1 Lissajous pattern on the self-contained oscilloscope permits the operator to see that he has achieved a precise one megacycle offset. The one megacycle offset is accounted for by adding one megacycle to the frequency reading displayed on the counter.

4-9 OBTAINING DIRECT READOUT

4-10 In the electronic digital counter, it is the number of pulses or events during a given length of time that is counted. A gate opening of one millisecond results in counting the number of cycles for a one millisecond period. The counter used in the system described has a basic range from 0 to 50 megacycles. In order to count and display the oscillator frequency over the range of 50MC to 150MC, the oscillator frequency is divided by three resulting in frequencies from 16.66 to 50MC that are accepted by the counter. The time base is then extended to three times the normal counting period and the counter will thereby count the oscillator frequency accurately and readout the frequency directly.

4-11 By the arrangement of two "Harmonic Number" decades and controlling circuitry a further extension of the time base is achieved. Any factor from 1 to 99 can be selected by the harmonic number switch on the transfer oscillator. Upon setting the harmonic number, the oscillator frequency will be multiplied automatically and the counter will then display the measured frequency directly. This preset feature allows the operator to approximate his harmonic number for quick measurements. Upon obtaining a frequency reading, a check is easily accomplished by dropping down to the next lower frequency that provides a zero beat and raising the harmonic number setting by one.

4-12 INDIVIDUAL CIRCUIT OPERATION

4-13 The detailed block diagram of the Model 1292 Transfer Oscillator is shown in Dwg. 15192. The individual circuit blocks are described below:

4-14 VARIABLE FREQUENCY OSCILLATOR & AMPLIFIER

4-15 Refer to Dwg. 14871. The variable frequency oscillator (VFO) is a Clapp type circuit consisting of Q101 and associated components followed by a two-stage tuned amplifier. The main tuning control, L1, is a ganged variable inductor common to the oscillator and amplifier stages. Each stage is designed to operate over the range of 50 to 150 MC. Fine tuning of the oscillator tank circuit is accomplished by a variable reactance diode, CR101. Varying the DC potential applied to the diode by R1, the front panel fine tuning control, changes the effective reactance of the diode and, consequently, the oscillator frequency. In the "AFC on" position of switch S1 (front panel), the junction between R103 and R106 is ungrounded, which adds the discriminator output control signal to the fine tuning circuit so that the corresponding oscillator harmonic locks in with the input frequency, producing a 1 MC beat frequency, (described under "Theory of Operation") which is displayed on the panel scope.

4-16 The oscillator output frequency is applied to the Harmonic Generator and Mixer through C106 and also to a divide-by-three circuit, the output of which is applied to the counter frequency input jack. Q105/Q106 is a differential limiter amplifier which drives the divide-by-three prescaler.

4-17 DIVIDE-BY-THREE PRESCALER

4-18 The divide-by-three prescaler is a three stage ring counter circuit. The rectangular waveform at the collector or any stage changes state at one third the frequency of the applied input signal. The output taken at the collector of Q111 is coupled through emitter-follower Q113 to J1, the front panel frequency output jack. Q114 is a voltage regulator stage which drops the +30V level down to +15V. The fixed reference voltage for the regulator is supplied by Zener diode CR106. A further voltage drop to +10V regulated for the fine tuning circuit of the oscillator section is obtained by means of Zener CR102.

4-19 TIME BASE SCALE OF THREE

4-20 Refer to Dwg. 14873. The Scale of 3 circuit extends the time base of the counter by a factor of 3 to compensate for the division by 3 of the VFO frequency which is applied to the counter. The circuit consists of a driver stage Q401 which applies the original time base frequency (normally 100 cps) to both the scale of 3 and the gating circuit, as shown in Figure 4-2. The scale of three consists of two cascaded binary stages having gating circuits which permute the normal scale of 4 to a scale of 3. Figure 4-3 illustrates the operation. The basic principles of the circuitry are similar to the decade units described in the counter manual and are not repeated here. The output taken at the collector of Q404 changes at one third the rate of the input signal. It is applied from terminal C to the preset decades.

4-21 GATING CIRCUITRY

4-22 A simplified block diagram of the gating circuitry is shown in Figure 4-2. The gate control signal from the counter is applied through amplifier Q408 and inverter Q409 so that a 0V level is applied to the "Gate Control" input of Gate A in the "gate closed" condition. Gate A then passes the time base pulses to amplifier Q410 and inverter Q407 to the time base out terminal, and one of these pulses starts the counting cycle in the counter after completion of the "inhibit start" function. Immediately, the gate in the counter changes to the "count" condition and the gate control signal applied to Gate A changes to +12V which closes this gate. Figure 4-4 illustrates Gate A. When the output of Q409 is 0V (not counting), the time base signal passes through CR406. When the output is +12V (counting), CR406 is reverse-biased and cannot conduct. Gate B is identical. Gate B remains closed during this entire time since it requires a coincidence pulse from the preset decades to cause it to open. When the coincidence pulse occurs, (See "Harmonic Preset Circuitry.") Gate B opens and passes the time base signal again to Q410. The first pulse closes the gate, stopping the counting cycle in the counter. Gate B is immediately closed following the coincidence pulse and Gate A is once again open, but a new counting cycle cannot commence until the reset action in the counter is completed.

4-23 The coincidence input at terminal K is normally at 0 volts (non-coincidence). Q411 is cutoff and its collector has a +12V potential which holds Gate B closed. When the coincidence output occurs, the 0V ground potential is removed, Q411 conducts and its output changes to 0V which opens Gate B. Q406 provides a reset level signal to the Scale of 3 binaries and to the harmonic preset decades. As long as the gate control signal is "off" (−6V), a +12V level at the collector of Q406 holds the scale of 3 and preset decades in the reset condition. When the gate is open, the level changes to 0V and the binaries are released from the reset condition.

4-24 HARMONIC GENERATOR AND MIXER

4-25 Refer to Dwg. 14875. The output of the oscillator in the range of 50 to 150 MC is applied to the harmonic generator. This consists of a diode CR602 located in the mixer assembly which generates an indefinite series of harmonics of the selected oscillator frequency. The input signal to be measured is mixed with the harmonic output signal by means of mixer diode CR601 located in the assembly. Two tuning rods are provided for maximum sensitivity, as observed on the monitor scope. The usable output of the mixer is the difference frequency resulting from the mixing of the input signal and the corresponding oscillator harmonic. This difference signal output at J4 is applied to the video amplifier for display on the scope. R324 is a DC vias level adjust for the mixer diode.

4-26 VIDEO AMPLIFIER

4-27 The video amplifier is a seven-stage, feedback compensated amplifier circuit (Q302 to Q308), designed to operate over the range of 10 cps to 2.5 MC. A voltage gain control (R3 on the front panel) located between stages Q304 and Q305 determines the vertical gain of the image displayed on the oscilloscope. The output of the video amplifier is taken at the collector of Q308 (a common-base configuration) and applied directly to the scope circuit through L302. It is also applied to the discriminator circuit through R312. Another output to the external scope jack J2 is taken from a preceding emitter follower stage, Q306. Refer to Schmatic 14875.

4-28 DISCRIMINATOR

4-29 In the "AFC on" condition, two inputs are applied to the discriminator circuit; the precise 1 MC reference frequency from the counter through C310 and the nominal 1 MC difference frequency from the video amplifier. A 1MC crystal, XY301, establishes the center frequency of the discriminator circuit.

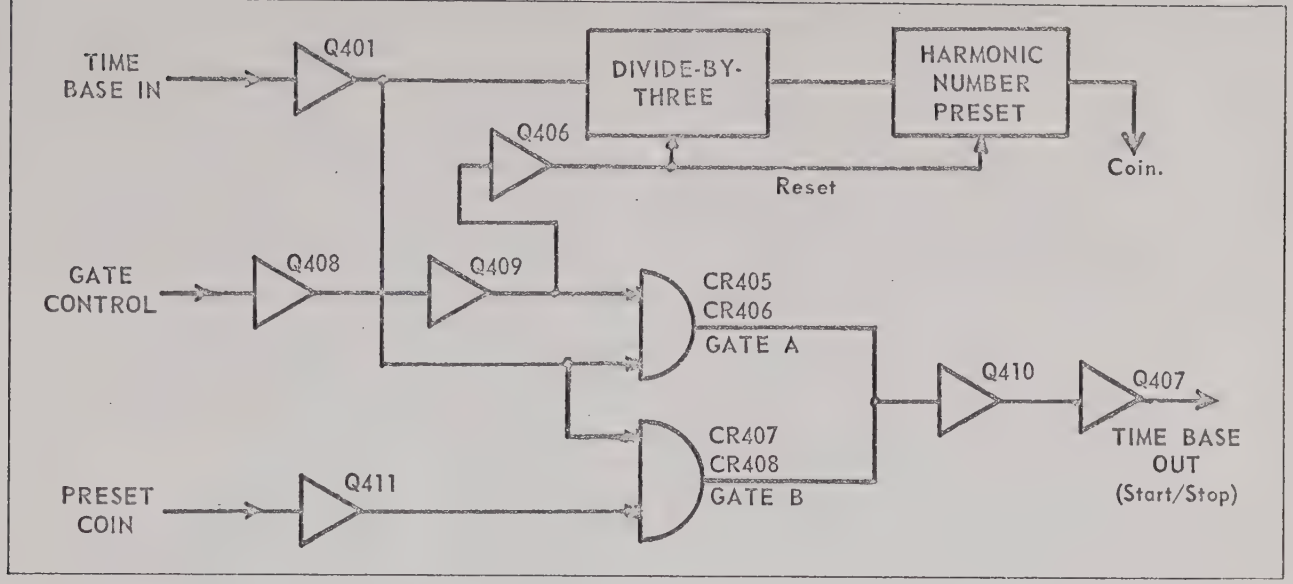


Figure 4-2 Time Base Gating Circuit Block Diagram

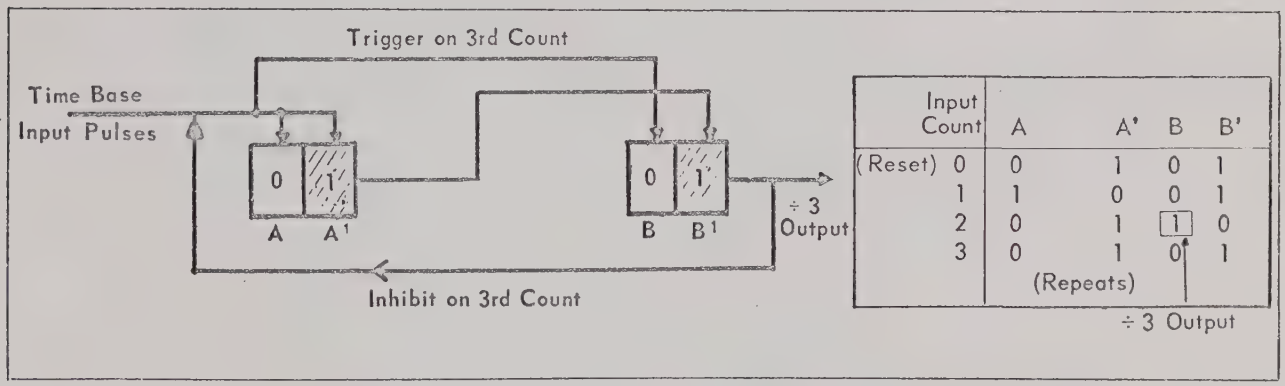


Figure 4-3 Operation of Binaries

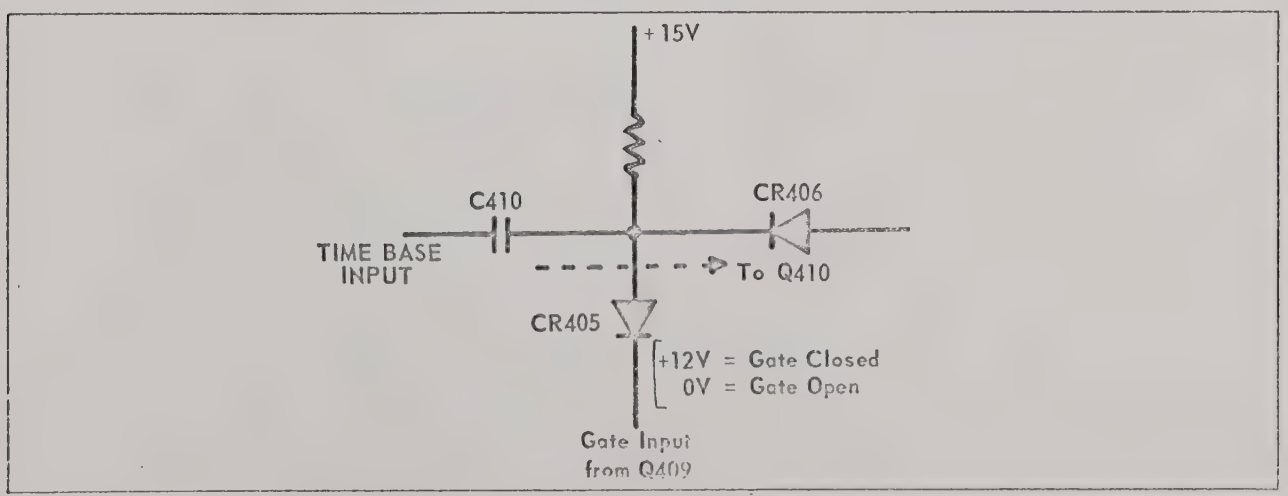


Figure 4-4 Gate A (Detail)

When the video input differs from 1 MC, a positive or negative error signal is applied to the variable reactance fine tuning circuit in the VFO, correcting the frequency in such a way as to make the video output exactly 1 MC. The functions of the adjustable capacitors are described in the discriminator calibration procedure.

4-30 When the video output is very close to 1 MC, diodes CR305 and CR306 provide a mixing action with the 1 MC reference frequency. The resulting output level from this action is a control signal which is derived from the phase difference between the 1 MC counter standard and maintains a precise 1 MC offset. Capacitor C325 adjusts the output of the discriminator for zero volts at 1 MC and C316 adjusts the symmetry of the characteristic response curve of the discriminator.

4-31 1 MC REFERENCE INPUT

4-32 In the "AFC on" condition, the emitter or Q301 is grounded. This stage amplifies the 1 MC standard frequency from the counter, passing it through C302 to the horizontal deflection plates or the CRT and also through C310 to the discriminator. The amplitude at pin 317 is approximately 100 volts peak-peak. When the emitter of Q301 is not grounded, the signal is blocked. Switch S1 selects a 60 cps, 85 volt r.m.s. signal from the transformer for horizontal deffection in the AFC off position.

4-33 CRT POWER SUPPLY

4-34 ±500 volts for the CRT is provided by the rectifier circuit (CR301 to CR304) operating from the high voltage transformer.

4-35 HARMONIC PRESET CIRCUITRY

4-36 Refer to Dwg. 14872. The circuitry consists of two decade units essentially the same as the decades described in section 8 of the basic counter instruction manual, but with one important difference. In a normal decade unit, a single output pulse is obtained at the 4th binary stage with the occurrence of every ten input pulses. Division by 10 is performed. In the preset decade, output lines are taken from each of the four binary stages. A ten position switch combines the outputs which used to represent the desired harmonic number according to the scheme given in table 1. If, for example, the switch is set at "8", all selected output lines will be at +12V on the 8th input pulses after reset and the gate formed by diodes CR519 to CR522 or CR523 to CR526 will be closed. This condition is equivalent to the coincidence signal. For all other input pulses, the output of at least one of the selected lines will be 0V and no coincidence condition will exist.

4-37 CENTERING CIRCUITRY

4-38 Refer to Dwg. 14877. The rear panel controls found on this module are identified as follows:

R204 - vertical positioning; R206 - horizontal positioning; R207 - focus; C206 - horizontal drive. The horizontal drive signal applied to terminal 218 is either a 60 cps 85V(rms) signal from the transformer in the AFC off position, or the 1MC 100V (peak-peak) signal in the AFC on position.

Table 4-1 Preset Binary Switch Code Selection

Switch Position	Binary Output				Common
	8	4	2	1	
0					x
1				x	x
2			x		x
3			x	x	x
4		x			x
5		x		x	x
6		x	x		x
7		x	x	x	x
8	x				x
9	x			x	x

SECTION V — MAINTENANCE

5.1 GENERAL

5-2 This section contains acceptance tests, alignment, trouble shooting, replacement procedures, and a list of suggested test equipment for the Model 1292 Transfer Oscillator.

5-3 ACCEPTANCE TESTS

5-4 Perform procedures of paragraphs 5-5 and 5-6 to check out Transfer Oscillator.

5-5 OSCILLATOR CHECK

a. Insert the Model 1292 Transfer Oscillator into the 1037 Series Counter. Turn on power.
b. Rotate the 1292 main tuning dial to the extreme clockwise position (150 Mc +)
c. Switch to AFC "OFF" position.
d. Set Counter TIME BASE switch to 10^{-1}, FUNCTION switch to rate, and RANGE switch to 1 position.
e. Install jumper cable (PN 14824) between counter C INPUT jack and output BNC jack on Model 1292. Adjust counter trigger level control. (See Counter Instruction Manual).
f. Set preset switches to "0 1" position. Observe reading on the counter of approximately 155,000.00 KC.
g. Turn the main tuning control counter clockwise. The frequency range must cover the range of 150 MC down to 50 MC.

5-6 PLUG-IN FUCTIONAL CHECK

a. Connect the Type "N" connector cable between the 1292 and HP 626A, Signal Generator. (Set generator to approximately 12.5 GC and 100 MV rms).
b. Tune T.O. for zero beat near 150 MC. Adjust tuning stubs for maximum vertical deflection on the scope. (Make stub adjustments with AFC "OFF").
c. Set counter TIME BASE Switch to 10^{-4}.
d. Set harmonic switches to the appropriate number to obtain a display of the signal frequency.
e. Turn the main tuning dial counter clockwise to the next zero beat and advance the harmonic switch to the next higher harmonic number. (Note that displayed reading should be reading obtained in step C to within accuracy and stability of measurement).
f. Use HP 626A set to 10 GC and repeat steps b and c.

NOTE

Considerably less signal than
100 MV rms may be used for steps 'f' thru 'i'.

g. Use HP 618B set to 6 GC and repeat steps 'b' and 'c'.
h. Use HP 612A set to 1 GC and repeat steps 'b' and 'c'.
i. Use HP 608C set to 250 MC and repeat steps 'b' and 'c'.
j. Use HP 608C set to 50 MC and repeat step 'b'.
k. Repeat 'a' thru 'i' with AFC switch "ON".
(Note that 1 MC must be added to the displayed reading).

Table 5-1 Suggested Test Equipment

EQUIPMENT	MODEL/TYPE	REQUIRED CHARACTERISTICS	USE
Multimeter	ME 260 or equivalent		Troubleshooting
Oscilloscope	Tektronix 581 or equivalent		VFO and Pre-scaler Video Amplifier and Mixer adjustment
Signal Generator	Measurements Corp. Model 182 or equivalent	50 KC – 50 MC	VFO and Pre-scaler Video Amplifier and Discriminator
Signal Generator	Hewlett Packard Model 628A or equivalent	10 KMC – 15 KMC	Mixer Adjustment
Signal Generator	Hewlett Packard 626A	7 KMC – 11 KMC	Bench & Function Check
Signal Generator	Hewlett Packard 618B	3800 MC – 7600 MC	Bench & Function Check
Signal Generator	Hewlett Packard 612A	450 MC – 1200 MC	Bench & Function Check
Signal Generator	Hewlett Packard 608D	10 MC – 420 MC	Bench & Function Check

5-7 ALIGNMENT

5-8 The following alignment procedures should be performed if absolutely necessary.

NOTE

Prior to performing alignment procedures a special test cable must be constructed. Refer to paragraph 5-12.

5-9 VARIABLE FREQUENCY OSCILLATOR AND PRESCALER ADJUSTMENT

a. Connect the plug-in to the counter as shown in Figure 5-1.
b. Rotate the 1292 main tuning dial to the extreme clockwise position.
c. Switch to AFC "OFF" position.
d. Connect Simpson 260, or equivalent, to test point A on oscillator board.
e. Adjust trimmer capacitors C119 through C126 (Figure 5-3) for maximum voltage indicated by the voltmeter. Repeat this step. (The output should indicate approximately 1.2 V). HG Diode OSC switch.
f. Adjust potentiometer R137 (Figure 5-3) to obtain a stable reading on the counter of approximately 156,000.00 KC. This adjusts input bias level for ring counter.
g. Set preset switches to "0 1" position.
h. Adjust C119 (oscillator frequency adjust) to obtain a counter reading of approximately 156 MC.
i. Turn the main tuning control counter clockwise. The frequency range must cover the range of 150 MC down to 50 MC.
j. Readjust R137, if necessary, to obtain a stable count over the entire frequency range.
k. Rotate the main tuning to 150 MC and adjust the drum dial setting to correspond, if necessary.

5-10 VIDEO AMPLIFIER AND CRYSTAL DISCRIMINATOR ALIGNMENT

a. Connect plug-in to counter as shown in Figure 5-1.
b. Switch AFC to "ON" position.
c. Apply a 1 MC signal of approximately 100 microvolts (rms) from the generator connected to P4 (the mating connector of the mixer marked "MIX," Figure 5-4).
d. With the external scope connected to the discriminator lead (terminal 108 Figure 5-3) adjust C118 (Figure 5-3) for minimum 1 MC output.
e. Check that the deflection on the panel monitor scope is approximately ¾ inches peak-peak.
f. Adjust R-201, R-206 and R-207 (Figure 5-5) for proper centering and focus of the circuit trace.
g. Adjust C-206 (Figure 5-5) for maximum horizontal deflection of the circuit trace.

WARNING
A 500 volt potential exists across this component, exercise care while making adjustment.

h. Set up external oscilloscope for DC input, 1 V/CM vertical deflection.
i. Adjust the signal generator frequency critically until a 1:1 Lissajous pattern (circle) is displayed on the panel scope.
j. Adjust C325 (Figure 5-4) to obtain zero DC voltage at lug 108.
k. Vary the signal generator frequency above and below the precise 1 MC setting and measure the maximum deviation from zero volts in either direction with the external scope. If necessary, adjust trimmer C316 (Figure 5-4) to obtain equal deviation in either direction.
Repeat several times, if necessary, to obtain zero.
l. Turn AFC "off". Readjust the input signal to 1 MC and adjust trimmer C315 (Figure 5-4) for maximum vertical deflection on the front panel scope.

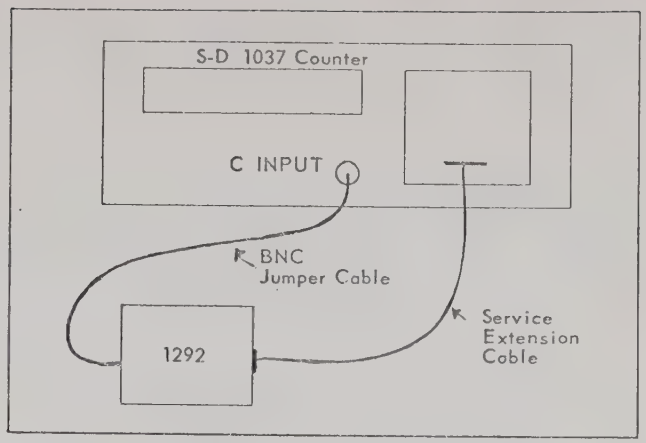


Figure 5-1 Test Set-Up

5-11 MIXER ADJUSTMENT

a. Reconnect P4 to Mixer connector and connect RG8 cable between plug-in signal input jack and HP 626A, Signal Generator. (Set generator to approximately 12.5 GC and 100 MV).
b. Turn for zero beat near the 150 MC dial setting.
c. Adjust R324 to the first peak in scope display from the maximum clockwise direction. (Setting should be approximately 10° from maximum clockwise).
d. Remove service cable and insert unit in counter.
e. Perform unit functional check of paragraph 5-6.

5-12 EXTENTION TEST CABLE CONSTRUCTION

a. Obtain one (1) male 50-pin connector (Amphenol Blue Ribbon pin 57-30500) one (1) female 50-pin connector (Amphenol Blue Ribbon pin 57-40500-2) and fourteen (14) standard 22 AWG wires.
b. Using non-acid core solder mate the connectors at their respective pin numbers as shown in Figure 5-2.
c. Perform a pin-to-pin continuity check to verify cable construction.

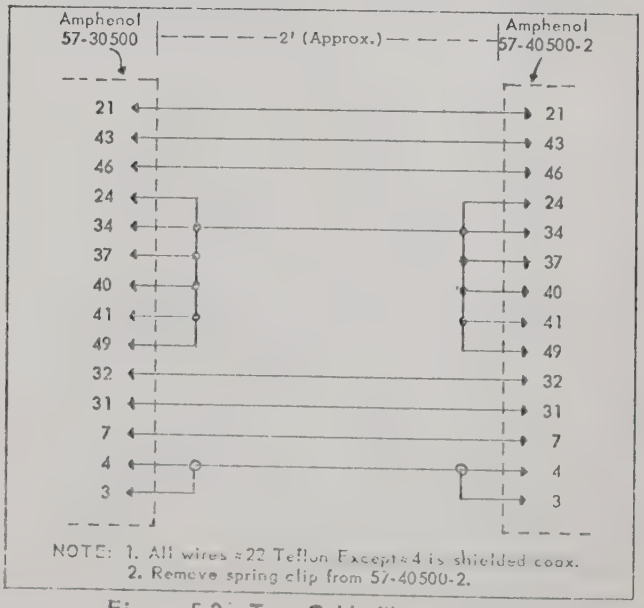


Figure 5-2 Test Cable Wiring Detail

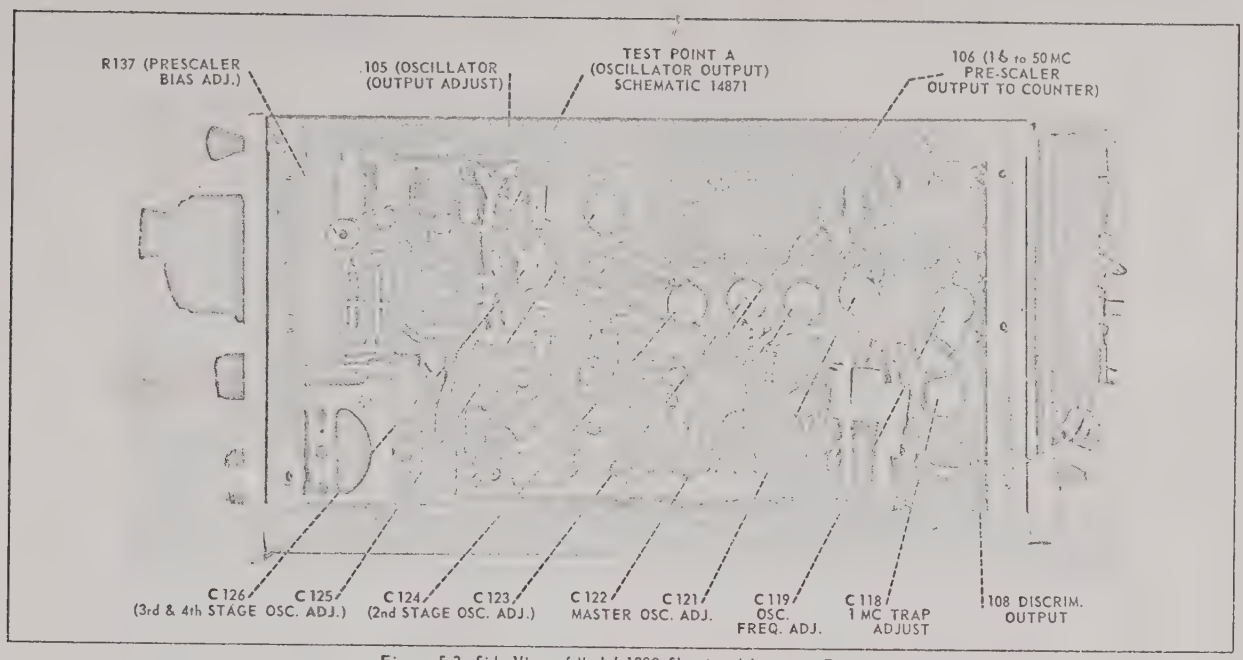

R137 (PRESCALER BIAS ADJ.)
105 (OSCILLATOR (OUTPUT ADJUST)
TEST POINT A (OSCILLATOR OUTPUT) SCHEMATIC 14871
106 (16 to 50 MC PRE-SCALER OUTPUT TO COUNTER)
C 126 (3rd & 4th STAGE OSC. ADJ.)
C 125
C 124 (2nd STAGE OSC. ADJ.)
C 123
C 122 MASTER OSC. ADJ.
C 121
C 119 OSC. FREQ. ADJ.
C 118 1 MC TRAP ADJUST
108 DISCRIM. OUTPUT

Figure 5-3 Side View of Model 1292 Showing Adjustment Points

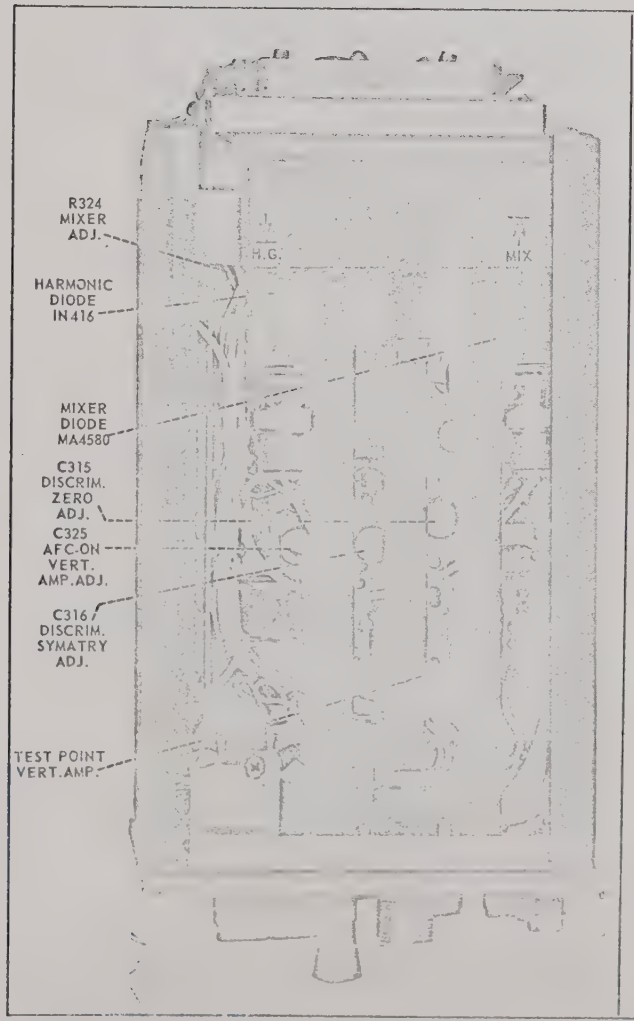


Figure 5-4 Bottom View of Model 1292 Showing Adjustment Points

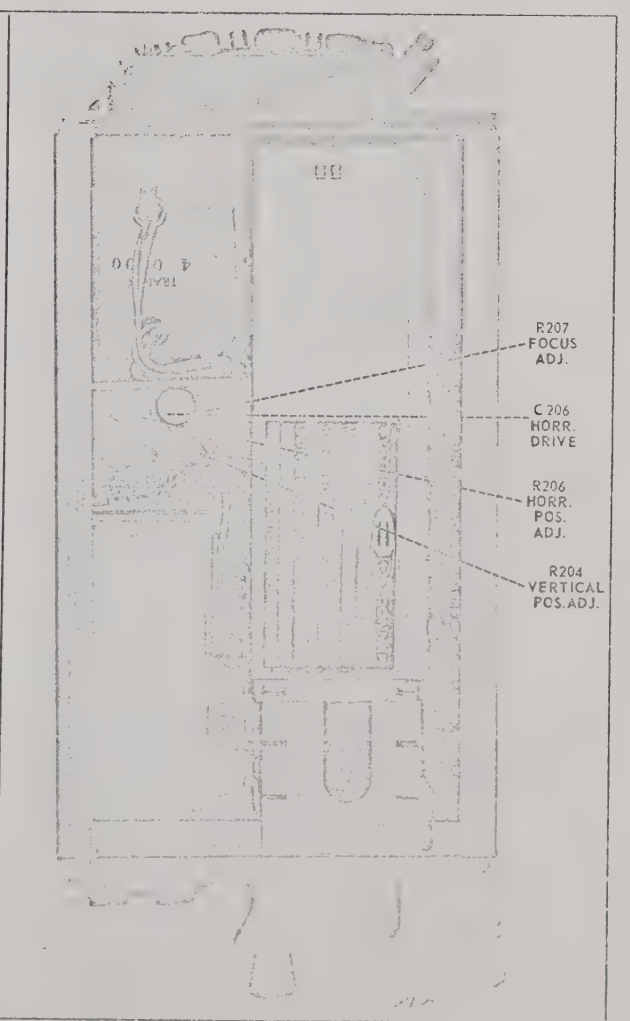


Figure 5-5 Top View of Model 1292 Showing Adjustment Points

5-13 TROUBLESHOOTING

5-14 When operation or alignment procedures indicate an instrument malfunction, refer to Table 5-2 (Troubleshooting) for the more common indications of trouble and check to isolate the trouble. After the trouble has been isolated to a particular assembly or stage, voltage and resistance checks can be made to determine the defective component.

Table 5-2 Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	REMEDY/CHECK
1. No scope sweep in AFC ON Position	Centering Circuit Capacitor C-206 misadjusted	Adjust C-206 per paragraph 5-10 Replace if required
	No 1 MC Input to transfer oscillator	Check that INTERNAL-EXTERNAL switch on counter rear panel is in INTERNAL position
	Video Amplifier Board Q301 Malfunction	Check for a ground indication at pin 316 (See Schematic Dwg. 14875).
2. No scope display in AFC OFF position	No 60 cycle input from counter	Check AC input connection (See Schematic Dwg. 15192)
3. Scope vertical display too small	Capacitor C-315 misadjusted	Adjust C-315 per paragraph 5-10
4. No counter readout or erratic readout	Pre-scaler oscillator malfunction	Adjust R-137 per paragraph 5-9
5. Incorrect answer on counter readout		
a. with preset switches in 0-0 position	Counter malfunction	a. Check counter per counter manual maintenance section
b. With preset switches in any position other than 0-0	Incorrect zero-beat Divide-by-Three or harmonic decades malfunction	b. Check zero beat. Check Divide-by-Three and harmonic decades. Place counter function switch in TEST position and rotate HARMONIC PRESET switches incrementally through operating range; observe counter readout at each increment. Readout should be equal to 3 times the preset switch reading at each increment.
6. No zero beat	Input signal too large or too small	(a) Check Mixer Diode (b) Check Harmonic Generator Diode (c) Remove BNC connector and check Video Amplifier output per paragraph 5-10
7. Low oscillator output voltage at Oscillator board Test Point "A"	Weak Harmonic Generator Diode or Oscillator	Check Harmonic Generator Diode and Oscillator

5-15 DISASSEMBLY AND REPLACEMENT

5-16 The following procedures are included as an aid in replacing the assemblies and components of the 1292 Transfer Oscillator. Refer to the block diagram, chassis assembly parts location drawing, or individual assembly parts location drawings in Section VI for wiring and part location information, as applicable, prior to replacing assemblies or components.

5-17 PRINTED CIRCUIT COMPONENT(S) Component lead holes in the Model 1292 printed circuit boards have plated walls to ensure good electrical contact between conductors on opposite sides of the board. To prevent damage to this plating and to the replacement component, apply heat sparingly and work carefully. The following procedure is recommended when replacing components or wiring.

a. Remove component or wiring by applying heat carefully to the component connection and lifting the component from the board.

b. Melt solder in component lead holes. Use clean dry soldering iron to remove excess solder. Clean holes with toothpick or wooden splinter. Do not use metal tool for cleaning. This may damage through hole plating.

c. Bend lead of replacement component to the correct shape and insert component leads into component lead holes.

d. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of board. A heat sink (long-nose pliers, commercial heatsink tweezers, etc.) should be used when replacing transistors and diodes to prevent conducting excessive heat from the soldering iron to the component.

e. Through-hole plating breaks are indicated by the separation from the board of the round conductor pad. To repair breaks, press conductor pads against board and solder replacement component lead to conductor pads on both sides of the board.

5-18 CATHODE RAY TUBE

a. Remove CRT retaining ring screws and retaining ring from front panel.

b. Push out CRT.

5-19 MIXER ASSEMBLY

a. Pull out mixer tuning stubs from front panel.

b. Using ¾" wrench, remove hex coupling nut and two teflon washers on front panel input jack.

c. Disconnect BNC connectors mated to mixer extention (underside of chassis) marked H.G. and MIX.

d. Remove two screws (Allen or Phillips, as applicable) which mate mixer assembly to lower rear portion of chassis frame.

e. Tilt and slide out mixer assembly.

f. To change either the mixer or harmonic diode, unscrew the connector designated MIX or H.G., as applicable, from the mixer brass extension and remove diode.

NOTE

The diode is installed between the connector and a brass fitting which is actually a capacitor. Insulating tape is used around the entire circumference of the capacitor. Ordinary scotch tape may be used as an insulator when replacing the diode.

NOTE

To facilitate unscrewing the BNC connectors to which the H.G. and MIX diodes are attached, a mating BNC connector and cable may be used.

5-20 TIME BASE

a. Remove four screws mating Time Base to Harmonic Preset board.

b. Unsolder wiring in accordance with paragraph 5-17 and remove assembly.

5-21 HARMONIC PRESET

a. Remove Time Base Assembly per paragraph 5-20.

b. Remove four screws mating assembly to chassis.

c. Unsolder wiring per paragraph 5-17 and remove assembly.

5-22 VIDEO AMP. DISC. H.V. POWER SUPPLY

a. Remove Mixer Assembly per paragraph 5-19.

b. Remove four screws mating assembly to side plate extention (See Figure 6-1).

c. Unsolder wiring per paragraph 5-17 and remove assembly.

5-23 OSCILLATOR, AMPLIFIER, PRE-SCALER

a. Unsolder wiring per paragraph 5-17.

b. Remove four common screws and lift out assembly.

5-24 CENTERING CIRCUIT BOARD AND TRANSFORMER

a. Remove mixer assembly per paragraph 5-19.

b. Remove Video Amp. Disc. H.V. Power Supply per paragraph 5-22.

c. Remove CRT per paragraph 5-18.

d. Remove six side panel screws and side panel.

e. Remove two Phillips screws mating CRT mount to side panel and two Phillips screws mating centering circuit board to side panel.

f. Unsolder circuit board wiring using techniques of paragraph 5-17 and remove centering circuit board.

g. To remove transformer remove four Phillips screws mating transformer to horrizontal member of side panel.

5-25 FRONT PANEL AND FRONT PANEL COMPONENTS

a. Remove GAIN, INTENSITY, and FINE TUNING knobs using No. 256 Allen wrench. If removing GAIN INTENSITY or FINE TUNING potentiometers, unsolder wiring per paragraph 5-17.

b. Remove Main Tuning Control using No.050 Allen wrench.

c. Remove Harmonic Preset switch as follows:

(1) Remove four screws and coverplate.

(2) Remove four screws mating switch assembly to chassis frame.

(3) Unsolder wiring per paragraph.

d. Remove VID OUT and OUTPUT jacks, respectively connectors J2 and J1, using 5/16" wrench. Unsolder wiring per paragraph 5-17.

e. Remove AFC switch (S1) as follows:

(1) Remove Mixer Assembly per paragraph 5-19.

(2) Unsolder switch wiring per procedure of paragraph 5-17.

(3) Using 3/16" wrench remove two nuts and switch assembly.

f. To remove front panel from chassis frame after performing steps a through e above, perform steps a, b, c and e of paragraph 5-29.

5-26 INDUCTUNER

a. Remove Oscillator Amplifier and Prescaler Assembly per paragraph 5-23.

b. Perform step a of paragraphs 5-20 and 5-21.

c. Remove four screws and rear panel from chassis frame.

d. Perform steps a through d of paragraph 5-24.

e. Insert No. 256 Allen wrench through hole in reduction drive housing and remove Allen screws from reduction drive worm gear.

f. Slide out inductuner.

g. Remove five screws mating inductuner to reduction gear housing.

5-27 DIAL AND HUB ASSEMBLY

a. Remove CRT per paragraph 5-18.

b. Rotate main tuning control until Allen screw access hole (located between 50 and 150 marks on dial assembly is visable from top of plug-in.)

c. Insert No. 256 Allen wrench and remove hub screw and Dial and Hub Assembly.

5-28 SHAFT AND GEAR ASSEMBLY

a. Remove Inductuner per paragraph 5-26.

b. Remove C washer on inside flange of reduction gear and shift and gear housing.

c. Using No. 256 Allen wrench loosen gear collar.

d. Remove Dial and Hub Assembly per paragraph 5-27.

e. Slide out shaft and gear.

5-29 REDUCTION DRIVE ASSEMBLY

a. Remove Inductuner per paragraph 5-26.

b. Remove Shaft and Gear Assembly per paragraph 5-28.

c. Remove main tuning control knob using No. 050 Allen wrench.

d. Remove four Phillips screws mating vertical members if reduction drive and gear housing to housing.

e. Using 1-1/8" wrench nut mating reduction gear assembly to chassis frame.

f. Slide out reduction drive assembly.

5-30 REDUCTION DRIVE ASSEMBLY HOUSING

a. Remove front panel and front panel components per paragraph 5-25.

b. Remove Inductuner per paragraph 5-26.

c. Remove four screws and housing from chassis frame.

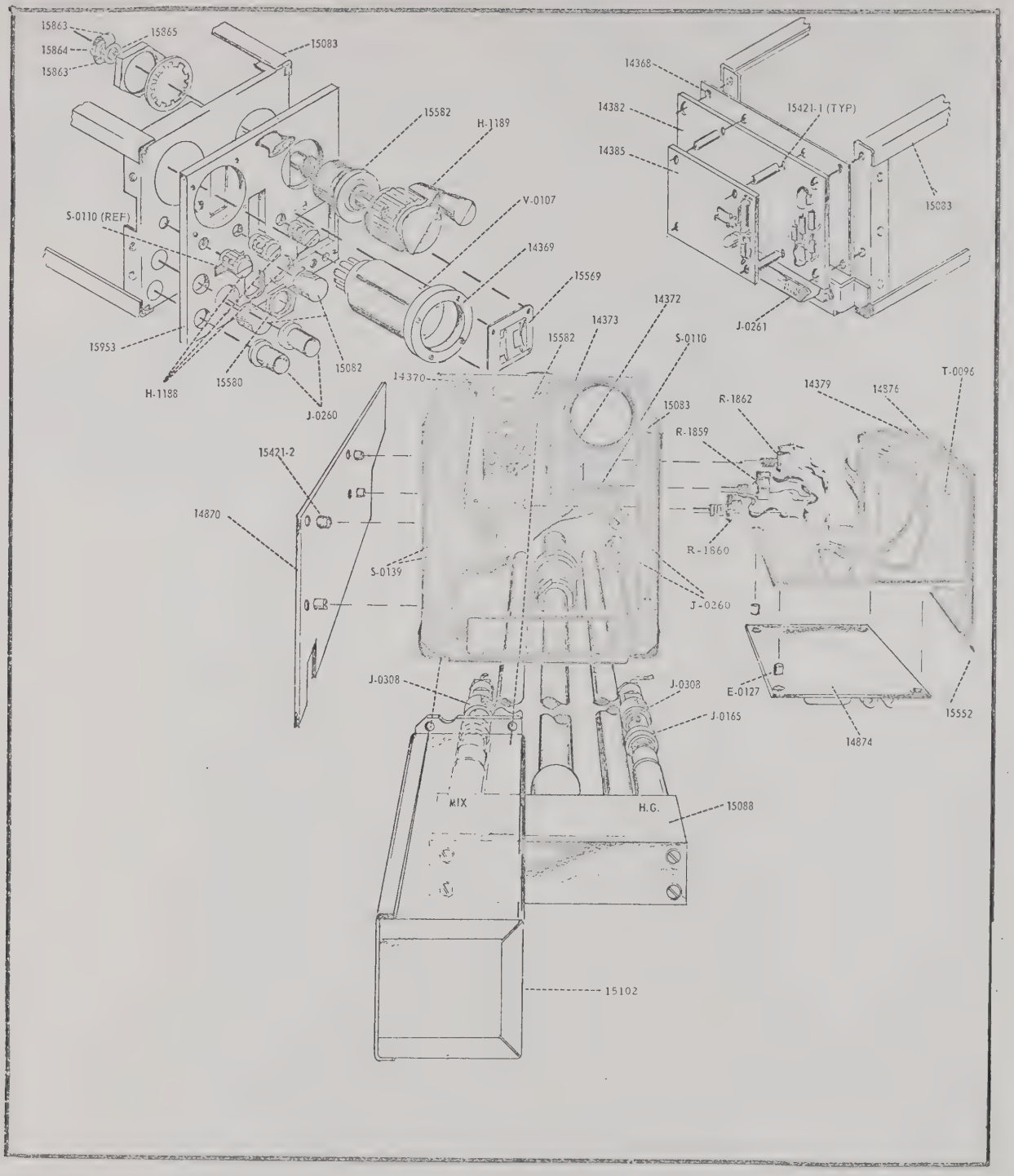


Figure 6-1 Chassis Assembly Parts Location Detail

SECTION VI — PARTS DATA AND SCHEMATICS

6-1 GENERAL

6-2 This section contains a separate parts location drawing, parts list, and a schematic for each modular assemblys contained within the plug-in. Each assembly parts list cites parts in alpha-numerical order of their circuit reference designators and indicates the part location reference and Systron-Donner stock number. A master parts list at the end of this section is keyed to each part in the assembly parts lists by Systron-Donner Stock number and provides the following information.

a. Systron-Donner Stock Number
b. Description
c. Manufacturer
d. Manufacturer's Part Number

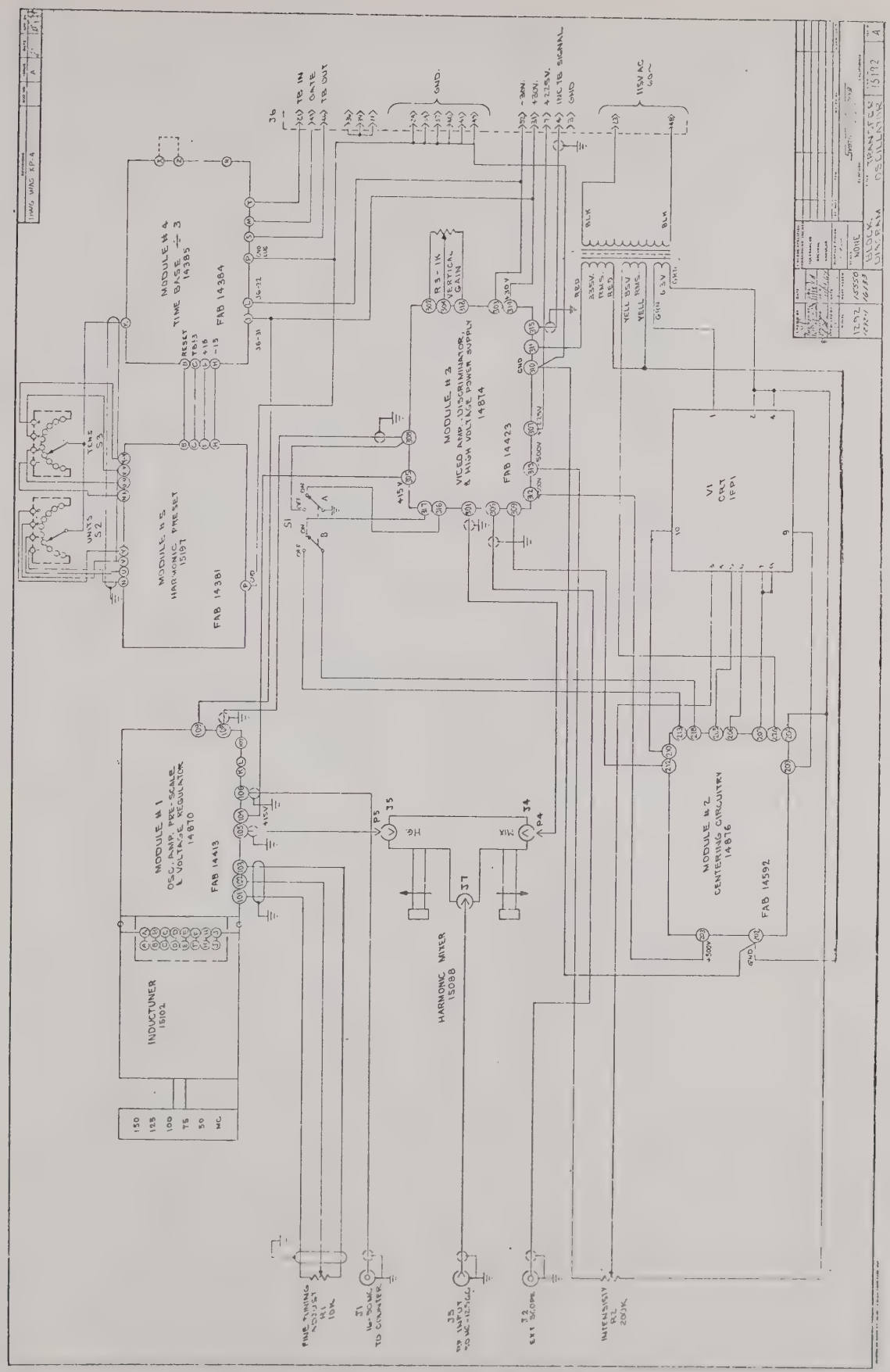
6-3 PARTS PROCUREMENT

6-4 To obtain replaceable parts, address order or inquiry to the nearest Systron-Donner Engineering Representative, or part manufacturer as applicable. The names and addresses of the Systron-Donner Engineering Representatives located in the continental United States and Canada are listed on the last page of this manual. Please supply as much of the following information as possible when ordering parts.

a. Systron-Donner Stock Number
b. Plug-in Model and Serial Number
c. Part Description
d. Part Function and Location

Table 6-1 Chassis Assembly Parts List

S-D Part No.	Description	Schematic Reference	S-D Part No.	Description	Schematic Reference
15560	Preset Switch and P. C. Brd. Assy's				
14385	Time Base divide-by-three Module	14873	14586	Fitting Mixer Input	
15421-1	Standoff (4)		J0307	Connector UG-160 B/U (RF Input)	J3, J7
H0675	Screw, PAN HD # 4-40 x 7/8 (Philips)		J0165	Connector BNC (VID OUT & OUTPUT)	J4, J5
14382	Harmonic Preset Module	14872	15083	Welded Frame Assembly	
E0127	Spacer		14368	Rear Panel Assembly	
H0980	Screw PAN HD 4-40 x ¼ (Philips)		J0261	Connector 50 pin	J6
16034	Harmonic Preset Switch Assy.		15953	Front Panel Assembly (Silk Screen)	
S0139	Switch Digit	S2, S3	J0260	Connector, BNC	J1, J2
H0378	Screw PAN HD 4-40 x¼ (Philips) (4)			Nut Mounting Hex 4-40	
15552	Oscillograph Assy. (Side Panel Assy's)			Washer	
H1152	Screws FL.HD 4-40 x ¼ (Philips)		S0110	Slide Switch (AFC ON-OFF)	S1
15556	Video Amplifier P.C. and Cable Assembly		H0510	Nut, Mounting Hex 4-40	
14874	Video Amplifier Xtal, Disc. H.V. Rect.Mod.	14875	H0378	Screw, FL HD 4-40 x ¼ (2)	
E0127	Spacer (4)		H1282	Washer, Toothlock No. 4	
H0430	Screw FL. HD 6-32 x ¼ (4)		H1188	Knob Tuning (Gain, Intensity, Fine Tuning)	
H0421	Screw FL. HD 6-32 x 3/16 (2)		H0979	Set Screw 2-56 x 1/16 (1 ea.)	
H0410	Washer, INT. Toothlock 6 (6)		H1189	Knob Tuning (Reduction Drive)	
15557	Cable Harness Assy.			Set Screw, 5/64" (1) req.	
J0308	Connector BNC	P4, P5	14369	Bezel, CRT	
R1860	Pot 10K (Fine Tuning)	R1	H0996	Screw FL.HD 1-72 x ¼ (4) req.	
R1862	Pot 1K (Vertical Gain)	R3	15569	Bezel, Harmonic Preset Switch	
15553	CRT Assy.		H980	Screw PAN HD 4-40 x ¼ (Philips) (4)	
14876	Centering Circuit Module	14877	15082	Knob, Mixer Shorting Stub	
14379	Chassis, Socket, CRT		H0979	Set Screw 2-56 x 1/16	
V0107	Tube CRT	V1	14583	Shorting Stub, Mixer	
T0096	Transformer	T1	14370	Block, Mounting 10:0 Ratio	
R-1859	Pot 200K (Intensity)	R2	15582	Reducer and Worm Gear Assy. (Reduction Drive)	
15559	Oscillator and Tunner Assembly		15579	Reducer	
14870	Oscillator, Prescaler & Voltage Regulator	14871	15100	Worm	
	Standoff			Nut, Hex. 1"	
	Screw			Washer, Star 1"	
15102	Inductunner	L0070	15866	Spring Coupling Assembly	
H0984	Screw PAN HD 6-32 x 3/8 (Philips)		15865	Collar, Gear End	
H0410	Washer Int. Toothlock No. 6		15864	Collar, Tunner End	
15088	Mixer Assembly	14875	15862	Spring	
	Nut, Mounting (mixed input fitting to front panel)		H0240	Set Screw 4-40 x 1/8	
			14372	Dial and Hub Assembly	
15580	Washer		15196	Dial	
H0208	Screw FL.HD (2-56 x ¼) (2 req.)		15101	Hub	
H0421	Screw FL.HDMS 6-32 x 3/16 (2 req.)		14373	Shaft, Gear and Dial	
H0410	Washer No. 6		H0740	Hub Set Screw 4-40 x 1/8	
15086	Tube and Case Assembly		14410	Gear, Worm, Bronze	
15551	Input Cable Assembly		H0979	Set Screw 2-56 x 1/16	

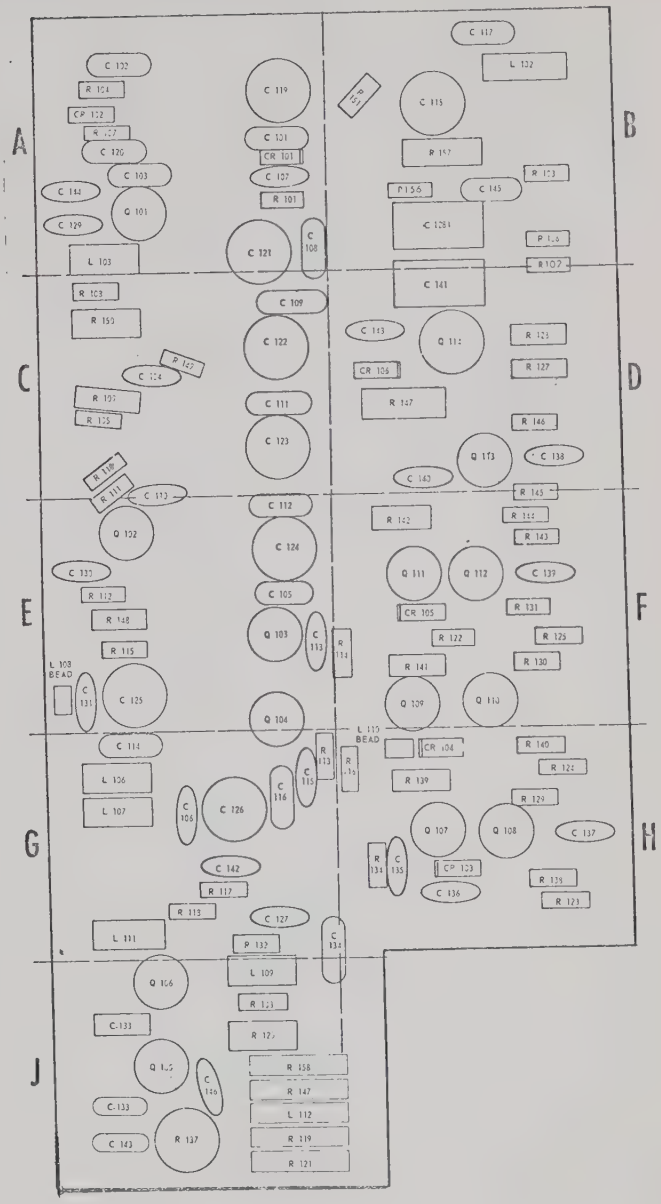


(Rev. 5-65) Figure 6-2 Model 1292 Transfer Oscillator Block Diagram

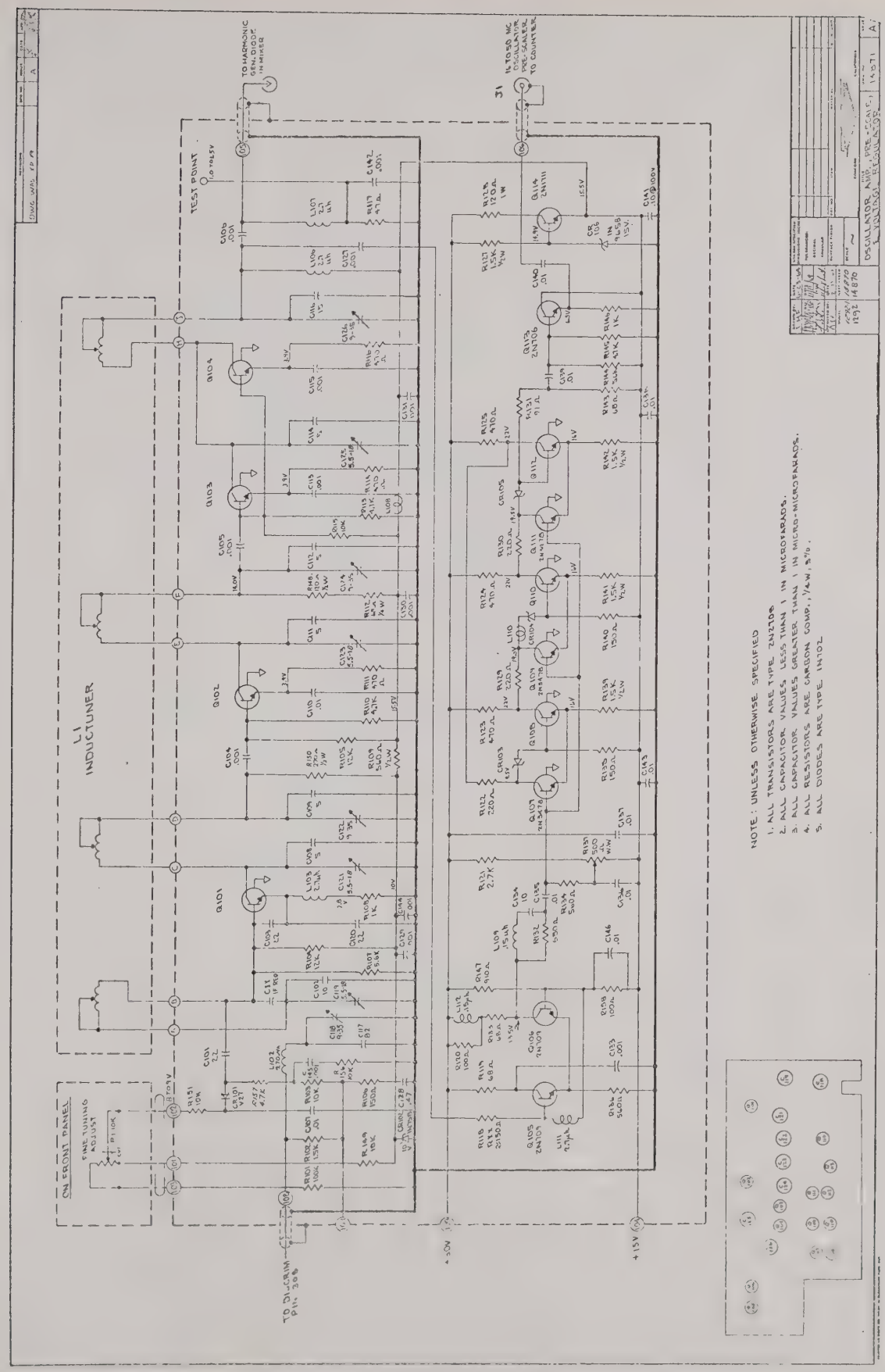
Table 6-2 Assembly 14870 Parts List

Circuit Ref.	Systron-Donner Part No.	Location Ref.	Circuit Ref.	Systron-Donner Part No.	Location Ref.
CAPACITORS					
C101	C-0529	A	C123	C-0712	C
C102	C-0527	A	C124	C-0709	E
C103	C-0529	A	C125	C-0712	E
C104	C-0424	C	C126	C-0709	G
C105	C-0424	E	C127	C-0424	G
C106	C-0424	G	C128	C-0720	B
C107	C-0233	A	C129	C-0424	A
C108	C-0596	A	C130	C-0424	E
C109	C-0596	C	C131	C-0424	F
C110	C-0233	C	C133	C-0424	J
C111	C-0596	C	C134	C-0527	G
C112	C-0596	E	C135	C-0233	H
C113	C-0424	E	C136	C-0233	H
C115*	C-0424	G	C137	C-0233	H
C116	C-0528	G	C138	C-0233	H
C117	C-0535	B	C139	C-0233	F
C118	C-0709	B	C140	C-0233	D
C119	C-0712	A	C141	C-0236	D
C120	C-0529	A	C142	C-0424	G
C121	C-0712	A	C143	C-0233	C
C122	C-0709	C	C144	C-0424	A
C114*	C-0596	G	C145	C-0424	B
DIODES					
CR101	CR-0218	A	CR104	CR-0140	H
CR102	CR-0112	A	CR105	CR-0140	F
CR103	CR-0140	H	CR106	CR-0153	D
RESISTORS					
R101	R-0741	A	R118	R-0983	G
R102	R-0783	B	R119	R-1426	J
R103	R-0766	B	R120	R-0966	J
R104	R-0759	A	R121	R-0937	J
R105	R-0759	C	R122	R-0760	F
R106	R-0983	B	R123	R-1044	H
R107	R-0821	A	R124	R-1044	H
R108	R-0765	C	R125	R-1044	F
R109	R-1083	C	R127	R-0267	D
R110	R-0892	C	R128	R-0725	D
R111	R-1044	C	R129	R-0760	H
R112	R-1426	E	R130	R-0760	F
R11-	R-0892	G	R131	R-1213	F
R114	R-1044	F	R142	R-0267	F
R115	R-0766	E	R143	R-1426	F
R132	R-1234	G	R144	R-0821	F
R133	R-1426	J	R145	R-0892	F
R134	R-0819	H	R146	R-0765	D
R136	R-0819	J	R147	R-0469	J
R137	R-1863	J	R148	R-0501	E
R138	R-0983	H	R149	R-0766	C
R139	R-0267	H	R150	R-0365	C
R140	R-0983	H	R151	R-0766	B
R141	R-0267	F	R156	R-0766	B
R116	R-1044	H	R157	R-0592	B
R117	R-0743	G	R158	R-1426	J
TRANSISTORS					
Q101	Q-0158	A	Q108	Q-0158	H
Q102	Q-0158	A	Q109	Q-0158	F
Q103	Q-0158	E	Q110	Q-0158	F
Q104	Q-0158	E	Q111	Q-0158	F
Q105	Q-0152	J	Q112	Q-0158	F
Q106	Q-0152	J	Q113	Q-0130	D
Q107	Q-0158	H	Q114	Q-0140	D
MISCELLANEOUS					
L101	L-0048	B	L109	L-0069	J
L102	L-0067	B	L110	H-0654	F
L103	L-0048	A	L111	L-0048	G
L106	L-0048	G	L112	L-0069	J
L107	L-0048	G	P5	J-0308	
L108	H-0654	E			

Figure 6-3
Assembly 14870 Parts Location Detail



OSCILLATOR, AMPLIFIER, PRE-SCALER AND VOLTAGE REGULATOR MODULE


L1
INDUCTUNER
TEST POINT
TO HARMONIC GENERATOR MIXER
TO COUNTER
FINE TUNING ADJUST
ON FRONT PANEL
TO DIGIRAM
+30V
+15V
NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL TRANSISTORS ARE TYPE 2N2708
2. ALL CAPACITOR VALUES LESS THAN 1 IN MICROFARADS.
3. ALL CAPACITOR VALUES GREATER THAN 1 IN MICRO-MICROFARADS.
4. ALL RESISTORS ARE CARBON COMP., 1/4W, 5%.
5. ALL DIODES ARE TYPE 1N702
OSCILLATOR, AMP., PRE-SCALER & VOLTAGE REGULATOR

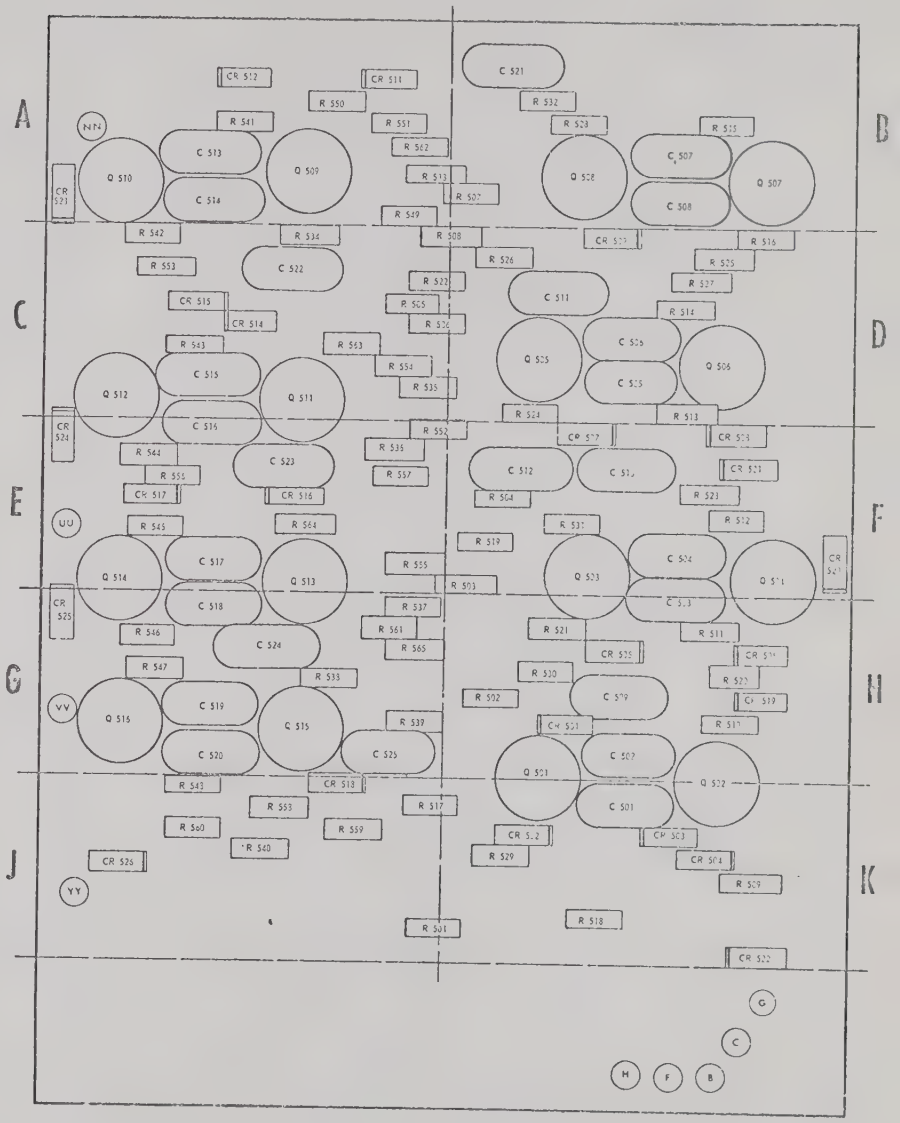
(Rev. 5-65) Figure 6-4 Oscillator Amplifier, Pre-Scaler, and Voltage Regulator Schematic

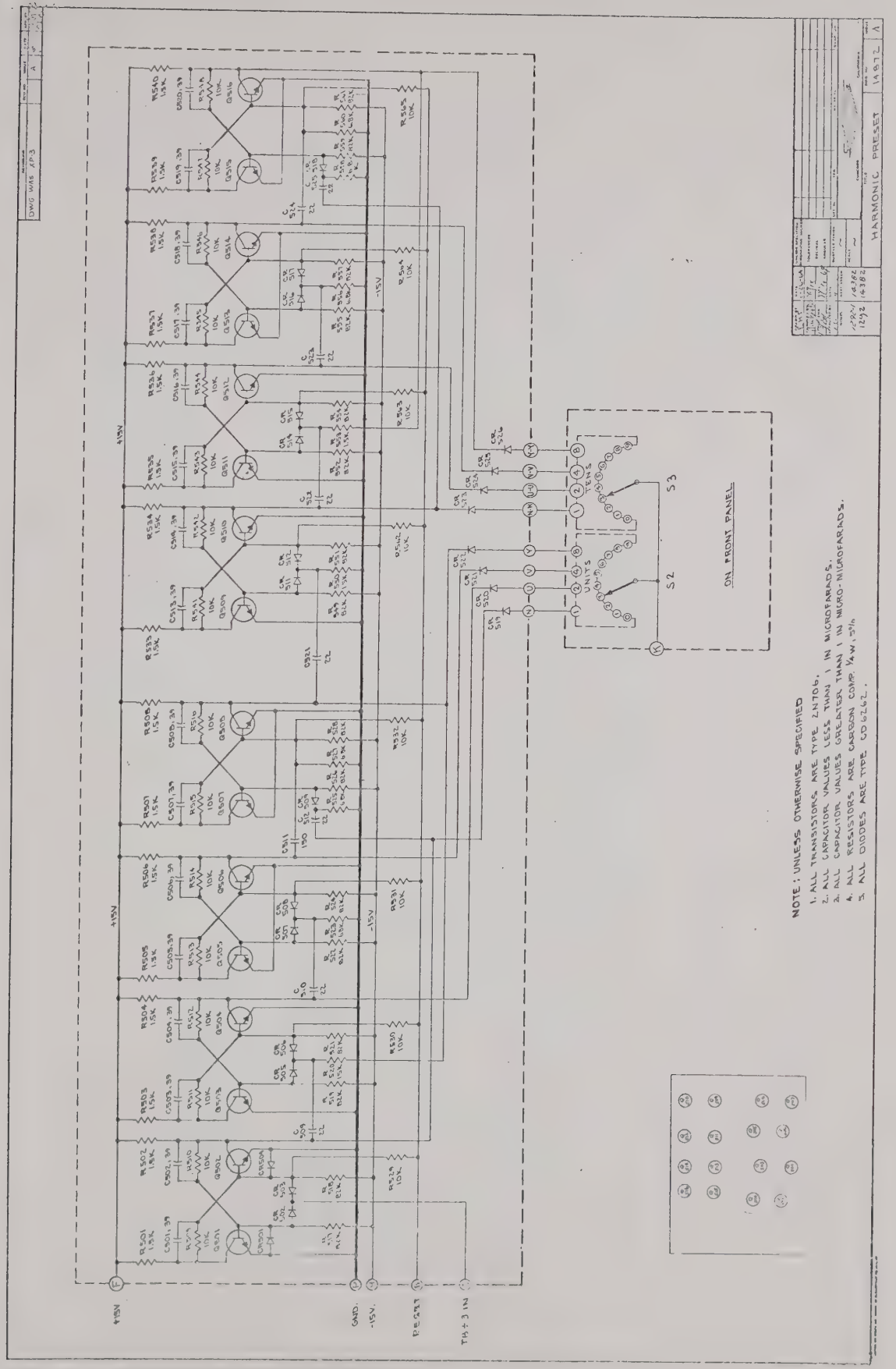
Table 6-3
Assembly 14382
Parts List

Circuit Ref.	Systron Donner Part #	Loc. Ref.
CAPACITORS		
C501	C-0532	K
C502	C-0532	H
C503	C-0532	H
C504	C-0532	F
C505	C-0532	D
C506	C-0532	D
C507	C-0532	B
C508	C-0532	B
C509	C-0529	H
C510	C-0529	F
C511	C-0539	D
C512	C-0529	F
C513	C-0532	A
C514	C-0532	A
C515	C-0532	C
C516	C-0532	E
C517	C-0532	E
C518	C-0532	G
C519	C-0532	G
C520	C-0532	G
C521	C-0529	B
C522	C-0529	C
C523	C-0529	E
C524	C-0529	G
C525	C-0529	G
DIODES		
CR501	CR-0150	H
CR502	CR-0150	K
CR503	CR-0150	K
CR504	CR-0150	K
CR505	CR-0150	H
CR506	CR-0150	H
CR507	CR-0150	F
CR508	CR-0150	F
CR509	CR-0150	D
CR511	CR-0150	A
CR512	CR-0150	A
CR514	CR-0150	C
CR515	CR-0150	C
CR516	CR-0150	E
CR517	CR-0150	E
CR518	CR-0150	J
CR519	CR-0150	H
CR520	CR-0150	F
CR521	CR-0150	F
CR522	CR-0150	K
CR523	CR-0150	A
CR524	CR-0150	E
CR525	CR-0150	G
CR526	CR-0150	J
TRANSISTORS		
Q501	Q-0130	H
Q502	Q-0130	H
Q503	Q-0130	F
Q504	Q-0130	F
Q505	Q-0130	D
Q506	Q-0130	D
Q507	Q-0130	B
Q508	Q-0130	B
Q509	Q-0130	A
Q510	Q-0130	A
Q511	Q-0130	C
Q512	Q-0130	C
Q513	Q-0130	E
Q514	Q-0130	E
Q515	Q-0130	G
Q516	Q-0130	G

Circuit Ref.	Systron Donner Part #	Loc. Ref.
RESISTORS		
R501	R-0783	K
R502	R-0783	H
R503	R-0783	F
R504	R-0783	C
R505	R-0783	D
R506	R-0783	B
R507	R-0783	D
R508	R-0783	B
R509	R-0766	K
R510	R-0766	H
R511	R-0766	H
R512	R-0766	F
R513	R-0766	D
R514	R-0766	D
R515	R-0766	B
R516	R-0766	B
R517	R-0784	K
R518	R-0784	K
R519	R-0784	F
R520	R-0783	H
R521	R-0784	H
R522	R-0784	D
R523	R-0696	F
R524	R-0784	D
R525	R-0696	D
R526	R-0784	D
R527	R-0696	D
R528	R-0784	B
R529	R-0766	K
R530	R-0766	H
R531	R-0766	F
R532	R-0766	B
R533	R-0783	B
R534	R-0783	C
R535	R-0783	D
R536	R-0783	E
R537	R-0783	G
R538	R-0783	G
R539	R-0783	J
R540	R-0783	A
R541	R-0766	C
R542	R-0766	C
R543	R-0766	E
R544	R-0766	E
R545	R-0766	G
R546	R-0766	G
R547	R-0766	J
R548	R-0766	A
R549	R-0784	A
R550	R-0783	F
R551	R-0784	C
R552	R-0784	C
R553	R-0783	E
R554	R-0784	E
R555	R-0784	E
R556	R-0696	E
R557	R-0784	J
R558	R-0696	J
R559	R-0784	J
R560	R-0696	A
R561	R-0784	C
R562	R-0766	E
R563	R-0766	E
R564	R-0766	G
R565	R-0766	G

Figure 6-5 Assembly 14382 Parts Location Detail





(Rev. 5-65)

Figure 6-6 Harmonic Preset Schematic

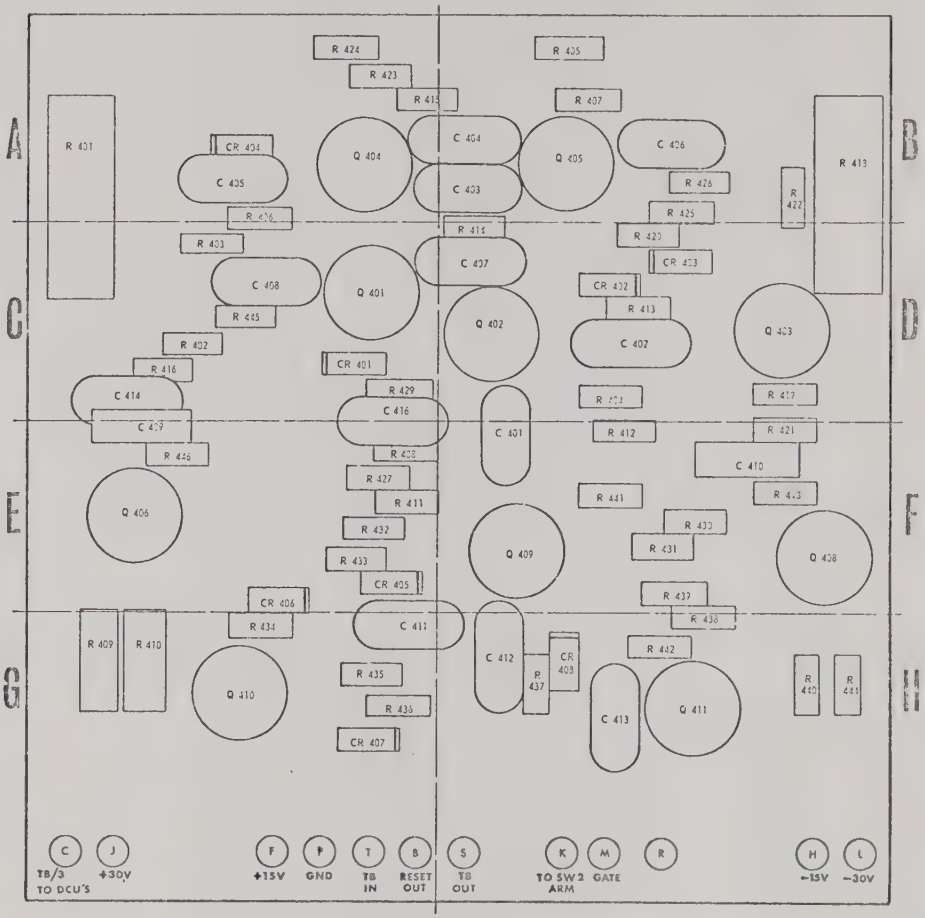
Table 6-4
Assembly 14385
Parts List

Circuit Ref.	Systron-Donner Part No.	Location Ref.
CAPACITORS		
C401	C-0531	F
C402	C-0531	D
C403	C-0531	B
C404	C-0531	B
C405	C-0528	A
C406	C-0378	B
C407	C-0531	D
C408	C-0531	C
C409	C-0524	E
C410	C-0524	F
C411	C-0536	G
C412	C-0536	H
C413	C-0424	H
C414	C-0528	C
C416	C-0424	C
DIODES		
CR401	CR-0150	C
CR402	CR-0150	D
CR403	CR-0150	D
CR404	CR-0150	A
CR405	CR-0150	E
CR406	CR-0150	E
CR407	CR-0150	G
CR408	CR-0150	H
TRANSISTORS		
Q-401	Q-0130	C
Q-402	Q-0130	D
Q403	Q-0130	D
Q404	Q-0130	A
Q405	Q-0130	B
Q406	Q-0130	E
Q408	Q-0130	F
Q409	Q-0130	F
Q410	Q-0130	G
Q411	Q-0130	H
RESISTORS		
R401	R-1674	A
R402	R-0728	C
R403	R-0766	C
R404	R-0783	D
R405	R-0783	B
R406	R-0783	A
R407	R-0783	B
R408	R-0759	E
R409	R-0260	G
R410	R-0260	G
R411	R-0765	E
R412	R-0766	F
R413	R-0766	D
R414	R-0766	D
R415	R-0766	A
R416	R-0892	C
R418	R-1592	B
R419	R-0784	D
R420	R-0783	D
R421	R-0784	F
R422	R-0696	B
R423	R-0783	A
R424	R-0784	A
R425	R-0784	B
R426	R-0766	B
R427	R-0959	E
R429	R-0784	C
R430	R-0728	F
R431	R-0959	F
R432	R-0696	E
R433	R-0783	E
R434	R-0728	G
R435	R-0728	G
R436	R-0765	G
R437	R-0728	H
R438	R-0759	H
R439	R-0728	F
R440	R-0765	H
R441	R-0821	F
R442	R-0892	H
R443	R-0759	F
R444	R-0777	H
R445	R-0766	C
R446	R-0783	F

Note: All resistors are 5% ¼w carbon, unless otherwise noted.)

Figure 6-7 Assembly 14385 Parts Location Detail

TIME BASE SCALE DIVIDE BY THREE MODULE



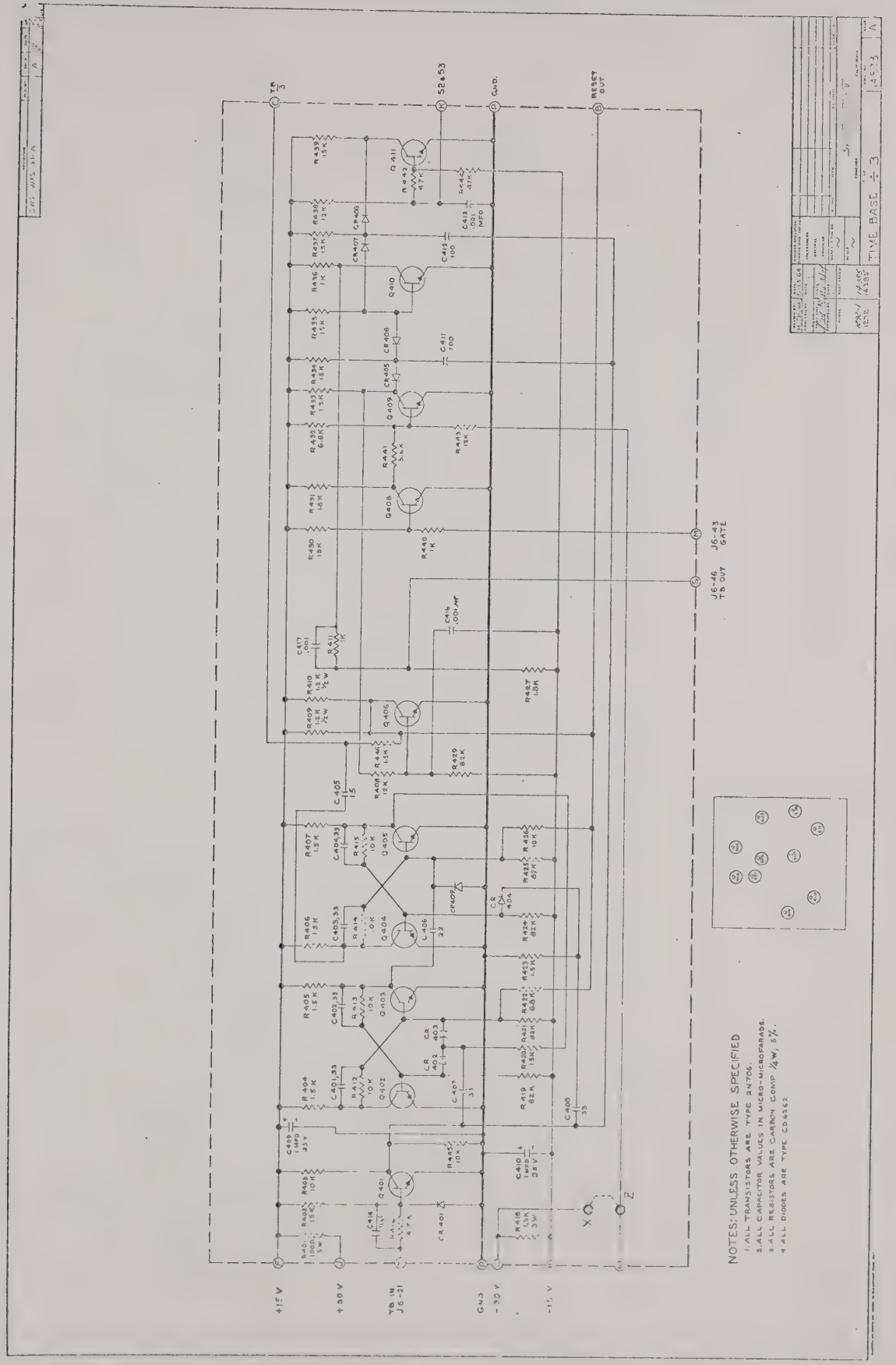


Figure 6-8 Time Base Scale of Three Schematic

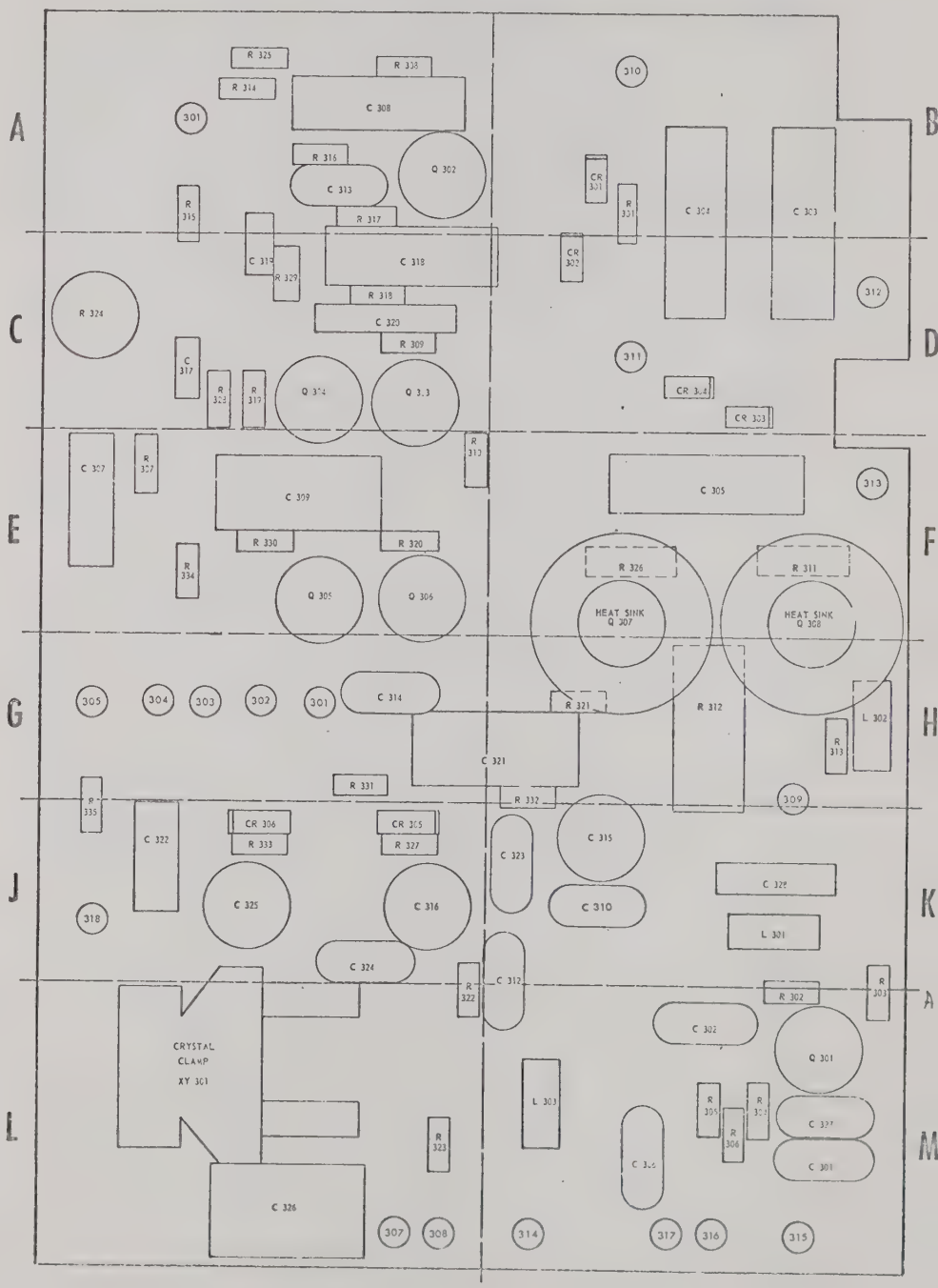
Table 6-5
Assembly 14874 Parts List

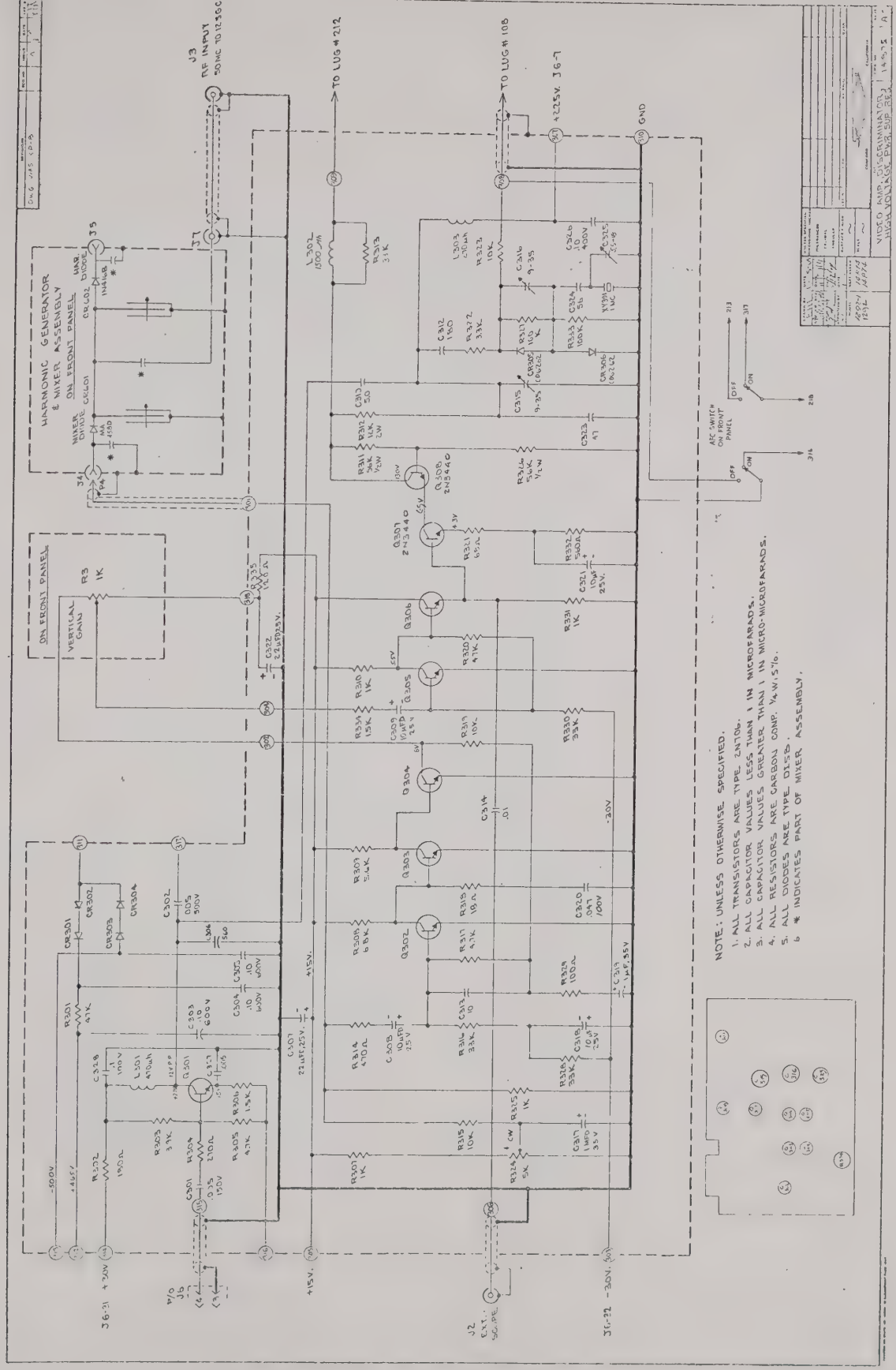
Circuit Ref.	Systron-Donner Part No.	Location Ref.
CAPACITORS		
C301	C-0325	M
C302	C-0425	N
C303	C-0105	B
C304	C-0105	B
C305	C-0105	F
C306	C-0644	M
C307	C-0371	E
C308	C-0365	A
C309	C-0365	E
C310	C-0596	K
C311	C-0425	M
C312	C-0643	K
C313	C-0527	A
C314	C-0562	G
C315	C-0709	K
C316	C-0709	J
C317	C-0524	C
C318	C-0365	C
C319	C-0524	C
C320	C-0788	C
C321	C-0365	H
C322	C-0371	J
C323	C-0533	K
C324	C-0534	J
C325	C-0648	J
C326	C-0399	L
C327	C-0325	M
C328	C-0236	K
DIODES		
CR301	CR-0078	B
CR302	CR-0078	B
CR303	CR-0078	D
CR304	CR-0078	D
CR305	CR-0150	J
CR306	CR-0150	J
CR601	CR-0227	Inside Mixer
CR602	CR-0219	Inside Mixer
RESISTORS		
R301	R-0777	B
R302	R-1233	M
R303	R-0939	M
R304	R-0694	M
R305	R-0892	M
R306	R-0783	M
R307	R-0765	E
R308	R-0696	A
R309	R-0821	C
R310	R-0765	E
R311	R-0137	F
R312	R-0500	H
R313	R-0780	H
R314	R-1044	A
R315	R-0766	A
R316	R-0780	A
R317	R-0892	A
R318	R-1546	C
R319	R-0766	C
R320	R-0892	E
R321	R-1426	H
R322	R-0742	L
R323	R-0766	L
R324	R-1858	C
R325	R-0765	A
R326	R-0137	F
R327	R-0741	J
R328	R-0780	C
R329	R-0966	C
R330	R-0780	E
R331	R-0765	G
R332	R-0819	H
R333	R-0741	J
R334	R-0783	E
R335	R-1461	J
COILS		
L301	L-0019	K
L302	L-0071	H
L303	L-0067	M
MISCELLANEOUS		
XY301	Y-0019	L
P4, P5	J-0305	
J4, J5	J-0165	
J7	J-0307	
TRANSISTORS		
Q301	Q-0130	M
Q302	Q-0130	A
Q303	Q-0130	C
Q304	Q-0130	C
Q305	Q-0130	E
Q306	Q-0130	E
Q307	Q-0172	F
Q308	Q-0172	F

(Note: All resistors are 5% ¼w carbon, unless otherwise noted.)

Figure 6-9 Assembly 14874 Parts Location Detail

VIDEO AMPLIFIER, DISCRIMINATOR, HIGH VOLTAGE POWER SUPPLY, REGULATOR AND HARMONIC GENERATOR/MIXER MODULE



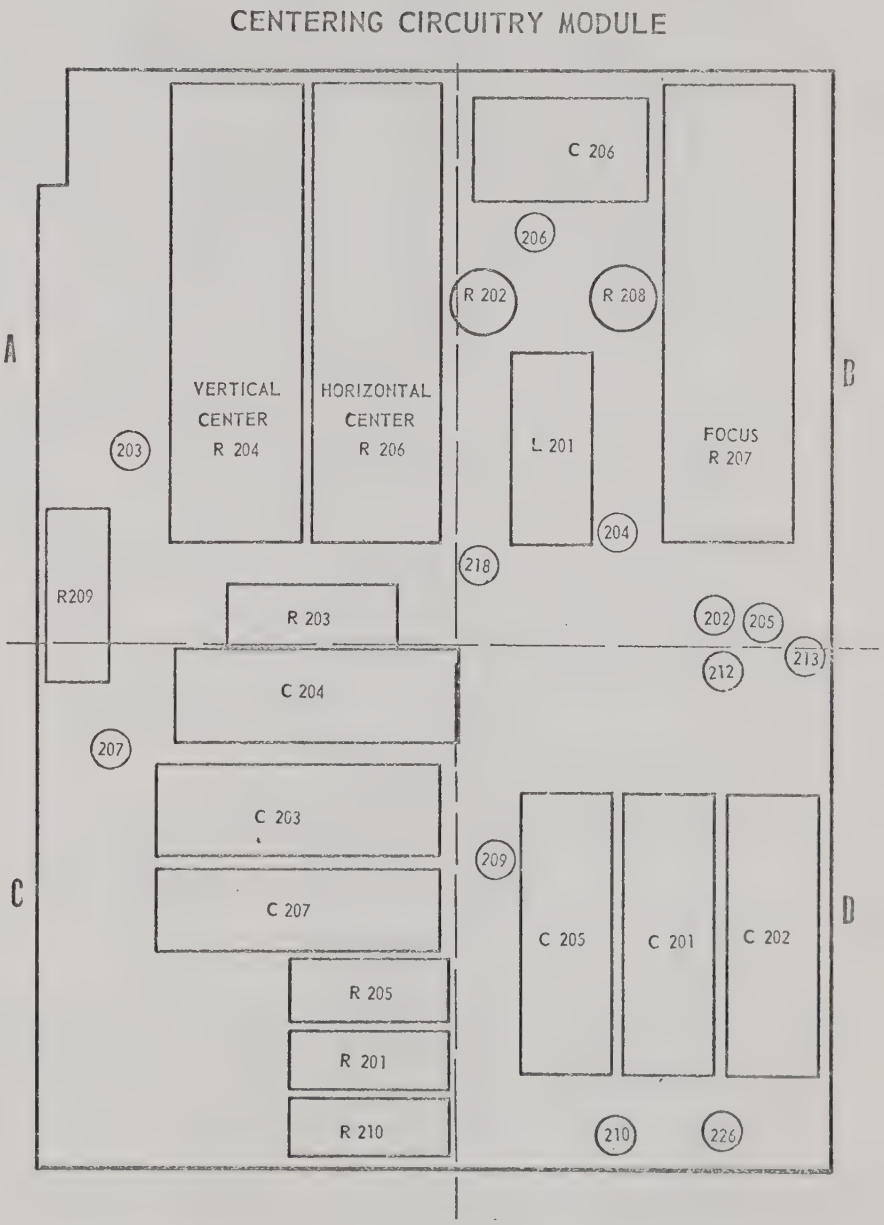


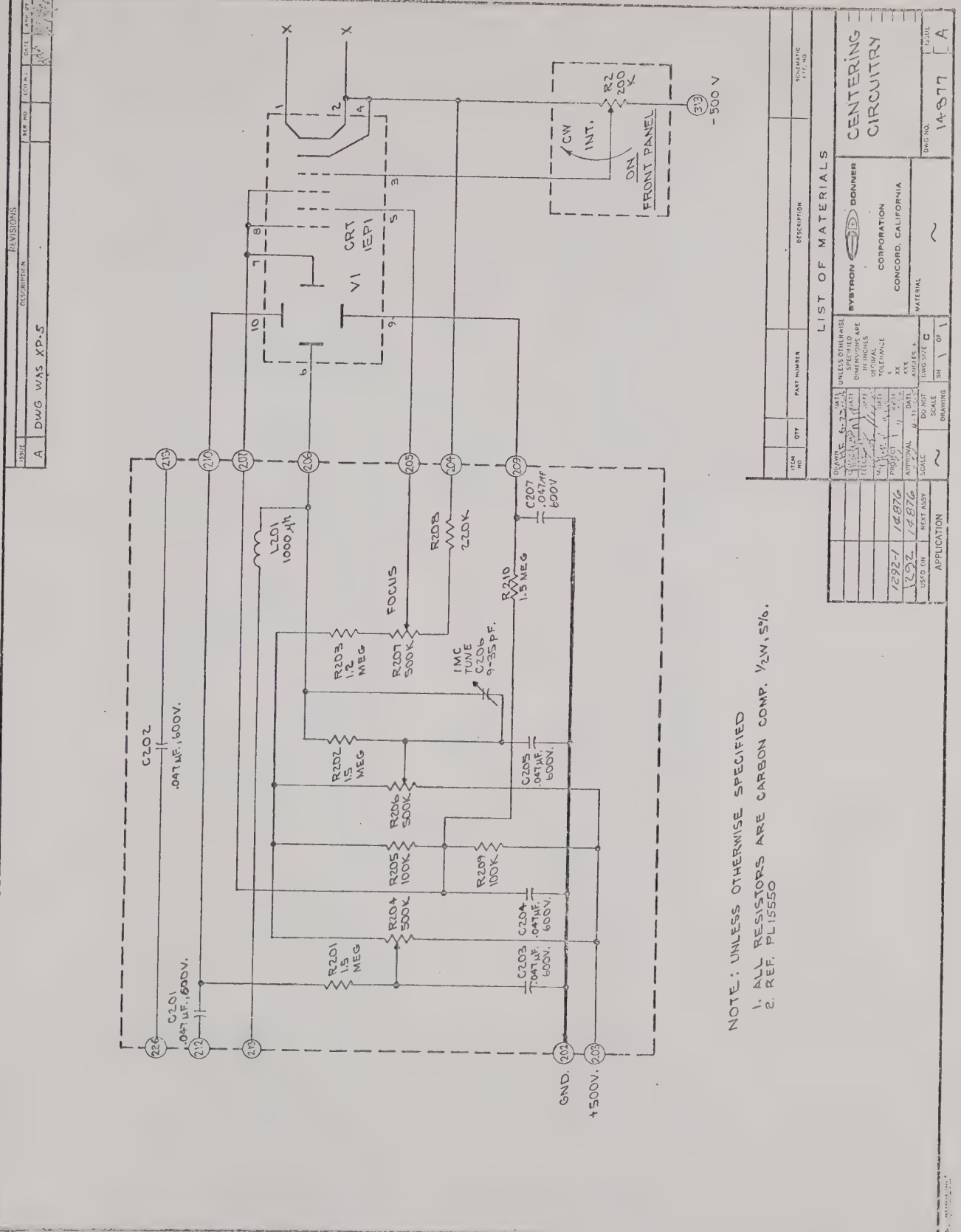
(Rev. 5-65) **Figure 6-10 Video Amplifier, Discriminator, High Voltage Power Supply, Regulator and Harmonic Generator/Mixer Schematic**

Figure 6-11 Assembly 14876 Parts Location Detail

Table 6-6
Assembly 14876 Parts List

Circuit Ref.	Systron-Donner Part No.	Location Reference
CAPACITORS		
C201	C-0793	D
C202	C-0793	D
C203	C-0793	C
C204	C-0793	C
C205	C-0793	D
C206	C-0792	B
C207	C-0793	C
MISCELLANEOUS		
L201	L-0068	B
RESISTORS		
R201	R-0148	C
R202	R-0148	B
R203	R-0358	A
R204	R-1861	A
R205	R-0352	C
R206	R-1861	A
R207	R-1861	B
R208	R-0264	B
R209	R-0352	C
R210	R-0148	C





(Rev. 5-65)

Figure 6-12 Centering Circuitry Schematic

Table 6-7 Model 1292 Transfer Oscillator Master Parts List

SYSTRON-DONNER PART NO.	DESCRIPTION	MANUFACTURER - PART NO.
CAPACITORS		
C-0105	.10uf, 600V, mylar paper tub.	Sprague 6TMP1
C-0233	.01uf +60, -40%, 150V, ceramic disc	Centralab DDM-103
C-0236	0.1 uf, 100V, ±20%, metalized paper	Electron Prod. M1-104
C-0325	.005uf, 10%, 150V, ceramic disc	Centralab DDM-502
C-0365	10uf, 25V, elec. tub.	Sprague TE 1204
C-0371	22uf, 25V, ±20%, tant. wet slug	Sprague 109D226X0025C2
C-0378	22pf, 500V, ±5%, dip. sil. mica	Cornell Dub. CD-15C-220J
C-0399	.10uf, 400V, ±20%, mylar, met. epoxy.	Electron DE 4-104
C-0424	.001uf, 500V, ±20%, cer. disc,	R.M.C. Type B
C-0425	.005uf, 500V, ±20%, cer. disc	R.M.C. SM Series
C-0524	1.0 uf, 35V, ±20%, tant.	TI, SCM105FP035D4
C-0527	10pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-100K-500V
C-0528	15pf, 10%, 500V, dip. sil. mica	El Menco DM-15-C-150K-500V
C-0529	22pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-220K-500V
C-0531	33pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-330K-500V
C-0532	39pf, 500V, ±10%, dip. sil. mica	ElMenco DM-15E-390K-500V
C-0533	47pf, ±10%, 500V, dip. sil. mica	ElMenco DM-15E-470K-500V
C-0534	56pf, 500V, ±10%, dip. sil. mica	ElMenco DM-15E-560K-500V
C-0535	82pf, 10%, 500V, dip. sil. mica	ElMenco DM-15E-820K-500V
C-0536	100pf, 10%, 500V, dip. sil. mica	ElMenco DM-15F-101K-500V
C-0539	270pf, 10%, 500V, dip. sil. mica	ElMenco DM-15F-271K-500V
C-0562	.01uf, 500V, ±20%, cer. disc	Sprague 19C214
C-0596	5pf, 10%, 500V, dip. sil. mica	ElMenco DM-15C-050-500V
C-0643	180pf, 10%, 500V, dip. sil. mica	ElMenco DM15F-181K-500V
C-0644	560pf, 10%, 500V, dip. sil. mica	ElMenco DM-15E-561K-500V
C-0648	Trimmer 5.5-18pf, NPO	Erie 538-002
C-0709	Trimmer 9-35pf	Erie 538-011-E2 PO-94R
C-0712	Trimmer 5.5-18pf	Erie 538-011 NPO5.5-18
C-0720	.47mfd, 10V, ±20%, cer. disc	Centralab Ultra Kap
C-0788	.047uf, 100V, ±20%, mylar, met.	Electron 2DE1-473
C-0792	Trimmer 9-35pf, right angle	Erie 538-006-9-35pf P.C. type
C-0793	.047uf, 600VDC ±20%	Electron D6-473
DIODES		
CR-0078	Type DI-58	Diodes, Inc.
CR-0112	Type 1N758	Transitron P.S.I.
CR-0140	Type 1N702A	P.S.I.
CR-0150	Type CD6262	Continental Devices
CR-0153	Type 1N965	Motorola
CR-0218	Varicap, V27	P.S.I.
CR-0219	Type 1N416B	Sylvania
CR-0227	Type MA458D	Microwave Associates
CONNECTORS		
J-0165	BNC w/grd lug	Automatic Metal UG1094/U
J-0308	Min. cable coaxial	Automatic Metal 801B1800
J-0260	Connector BNC less nut & washer	BNC 061094A/U
J-0261	Connector, Male 50-pin	Amphenol 57-10500
J-0307	Connector, Male	Amphenol UG-160 B/U
INDUCTORS		
L-0019	Choke, 470uf	Nytronics, Wee 470
L-0048	Choke, 2.7 microhenry	Wee-Ductor
L-0067	Choke, 270 microhenry	Stanwyck, Dink 270
L-0068	Choke, 1000 microhenry	Stanwyck, Dink 1000
L-0069	Choke, .15 microhenry	Stanwyck, Dink .15
L-0071	Choke, 1500 microhenry	Delevon, 2500-36

Table 6-7 Model 1292 Transfer Oscillator Master Parts List (cont.)

SYSTRON-DONNER PART NO.	DESCRIPTION	MANUFACTURER - PART NO.
TRANSISTORS		
Q-0130	Type 2N706	Philco
Q-0140	Type 2N1711	Raytheon, Fairchild
Q-0152	Type 2N709	Fairchild
Q-0158	Type 2N2708	R.C.A.
Q-0172	Type 2N3440	R.C.A.
RESISTORS		
R-0148	Comp. carb. 1.5MΩ, 1/2W, 5%	Allan Bradley EB1555
R-0260	Comp. carb. 1.2K, 1/2W, 5%	Allan Bradley EB1225
R-0264	Comp. carb. 220K, 1/2W, 5%	Allan Bradley EB2245
R-0267	Comp. carb. 22MΩ, 1/2W, 5%	Allan Bradley EB2265
R-0352	Comp. carb. 100K, 1/2W, 5%	Allan Bradley EB1045
R-0358	Comp. carb. 1.2M, 1/2W, 5%	Allan Bradley EB1255
R-0365	Comp. carb. 270Ω, 1/2W, 5%	Allan Bradley EB2715
R-0469	Comp. carb. 470Ω, 1W, 10%	Allan Bradley GB4711
R-0500	Comp. carb. 12K, 2W, 5%	Allan Bradley HB1235
R-0501	Comp. carb. 120Ω, 1/2W, 5%	Allan Bradley EB1215
R-0592	Comp. carb. 4.7K, 1/4W, 5%	Allan Bradley CB
R-0694	Comp. carb. 270Ω, 1/4W, 5%	Allan Bradley CB2715
R-0696	Comp. carb. 6.8K, 1/4W, 5%	Allan Bradley CB6825
R-0725	Comp. carb. 180Ω, 1/2W, 5%	Allan Bradley EB1815
R-0728	Comp. carb. 15K, 1/4W, 5%	Allan Bradley CB1535
R-0137	Comp. carb. 56K, 1/2W, 5%	Allan Bradley EB5635
R-0741	100K, 1/4W, 5%	Allan Bradley
R-0742	3.3K, 1/4W, 5%	Allan Bradley
R-0743	47Ω, 1/4W, 5%	Allan Bradley
R-0759	Comp. carbon, 12K, 1/4W, 5%	Allan Bradley CB1235
R-0760	Comp. carbon, 22Ω, 1/4W, 5%	Allan Bradley CB2215
R-0765	1K, 1/4W, 5%	Allan Bradley
R-0766	10K, 1/4W, 5%	Allan Bradley
R-0777	47K, 1/4W, 5%	Allan Bradley
R-0780	33K, 1/4W, 5%	Allan Bradley
R-0783	Comp. carbon, 1.5K, 1/4W, 5%	Allan Bradley CB1525
R-0784	82K, 1/4W, 5%	Allan Bradley
R-0819	560Ω, 1/4W, 5%	Allan Bradley
R-0821	5.6K, 1/4W, 5%, comp. carbon	Allan Bradley Type CB
R-0892	4.7K, 1/4W, 5%	Allan Bradley
R-0937	2.7K, 1/4W, 5%, comp. carbon	Allan Bradley
R-0939	3.9K, 1/4W, 5%, comp. carbon	Allan Bradley
R-0959	1.8K, 5%, 1/4W, comp. carbon	Allan Bradley
R-0966	100Ω, 5%, 1/4W, comp. carbon	Allan Bradley Type CB
R-0983	150Ω, 1/4W, 5%	Allan Bradley Type CB
R-1044	470Ω, 1/4W, 5%, comp. carbon	Allan Bradley Type CB
R-1083	560Ω, 1/2W, 5%, carbon comp.	Allan Bradley
R-1213	91Ω, 1/4W, 5%, carbon comp.	Allan Bradley
R-1233	180Ω, 1/4W, 5%	Allan Bradley
R-1234	680Ω, 1/4W, 5%	Allan Bradley
R-1426	68Ω, 1/4W, 5%	Allan Bradley CB6805
R-1461	120Ω, 1/4W, 5%, carbon comp.	Allan Bradley CB1215
R-1546	18Ω, 1/4W, 5%, carbon comp.	Allan Bradley
R-1592	W.W. 1500Ω, 3W, 5%, blue jacket	Sprague 242E1525
R-1674	100Ω, 5W, 5%, type 246-E	Sprague 243E1015
R-1807	270Ω, 1W, ±10%, comp carbon	Allan Bradley GB2715
R-1858	Potentiometer 5K	Spectrol 82-3-8-502
R-1861	Potentiometer 500K, 1/2W, 5%	Bourns 3068P-1-504
R-1863	Potentiometer 500Ω	Spectrol 82-3-8-501
MISCELLANEOUS		
H-1187	Heat sink, transistor	I.E.R.C. TXBF 032-0258
Y-0019	Crystal, 1Mc	X-Tron CR-18/U

Table 6-7 Model 1292 Transfer Oscillator Master Parts List (cont.)

SYSTRON-DONNER PART NO.	DESCRIPTION	MANUFACTURER – PART NO.
MISCELLANEOUS		
14372	Dial and Hub Assembly	Systron-Donner
H-1229	Dial Drum Hub	Sterling GB-8
14373	Shaft, Gear and Dial	Sterling E62-3
15582	Reducer and Worm Gear Assembly	Systron-Donner
14410	Gear Bronze Pitch, Worm	Boston Q-1318
15102	Inductuner	Mallory HT 344-O
R-1859	Pot, 200k	Mallory MLC - 200k
R-1860	Pot, 10k	Mallory MLC - 10k
R-1862	Pot, 1k	Mallory MLC - 1k
S-0110	Switch, Slide	Chicago Dynamic Ind. stockpole SS 50 DPDT
S-0139	Switch, Digit	Chicago Dynamic Ind. MTTSB-P-10
	Mounting Frame, Switch and Digit	Chicago Dynamic Ind. TS 100532-2
T0096	Transformer	Tranex 4-6800
V-0107	Tube, CRT	RCA – 1 EP1
H-1188	Knob, tuning	Ratheon Black Matte 50-2-1G
H-1189	Knob Reduction Drive	Ratheon Black Matte 125-6-2G

ADDENDUM
TO
INSTRUCTION MANUALS
FOR
MODELS 1292 AND 1297 TRANSFER OSCILLATORS

1.68.VJ

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MODEL 1297

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A1. HARMONIC PRESET ASSEMBLY - 23704

A1.1 Overall Functional Description

In current models of the 1292 Transfer Oscillator, the time base ÷3 and harmonic preset modules have been replaced by a single assembly. For this assembly, drawings 15192, 23704 and 23705 apply.
The basic logic as illustrated in Figure A1-1 is retained with the exception that the reset pulse is taken from the NPN reset line(terminal J6-45) of the counter. The logic gates, scale-of-three binary and the preset decades have been replaced with integrated circuit units. Refer to drawing 23705 for the discussion that follows

A1.2 Functional Section Description

a. Start Pulse Generator. The start pulse for the counter gate is generated by the counter time base signal at terminal 6 and the gate OFF condition (-6V) at terminal 4. The zener diode CR401 and the internal circuitry of the NAND gate (IC407D) provide the logic level change necessary to activate one input terminal of this gate. The other input terminal is activated by the gate OFF condition after a level change through Q401 and inversion by IC407B. The output of NAND gate IC407D is coupled through C401 to the base of Q402. This coupling results in a negative spike at the base of Q402 which is then inverted and becomes the positive start pulse for the counter gate at terminal 5. The start of the counter gate will then drive terminal 4 to 0V.

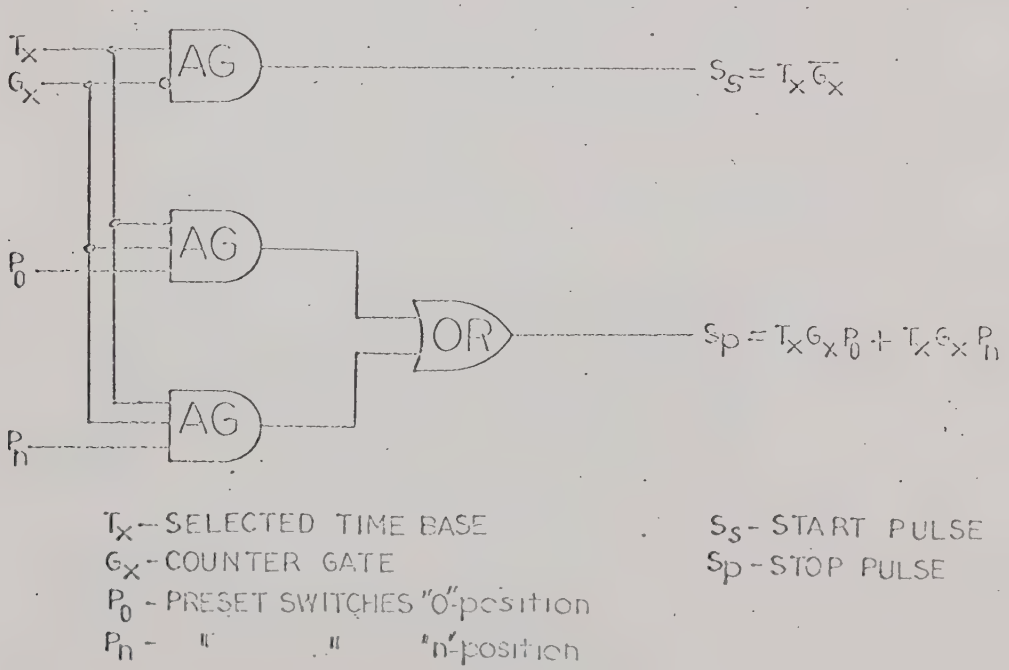
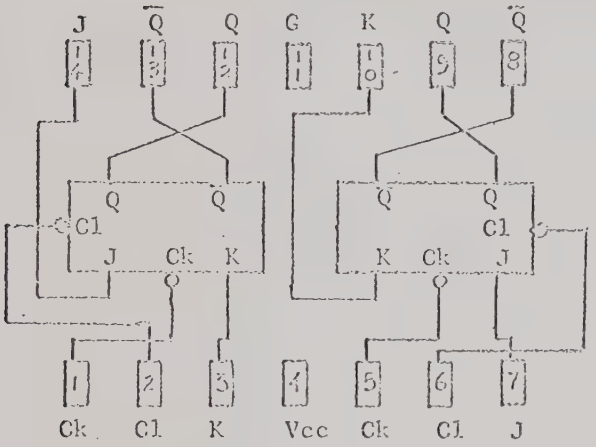


Figure A1-1 Harmonic Preset Circuit - Basic Logic Diagram

b. Scale-of-Three Binary. To compensate for the division of the VFO frequency, the counter gate must initially be extended by the same factor in order to provide a correct frequency indication on the counter display. This is accomplished by IC401, a dual J/K flip-flop connected for scale-of-three. See Figure A1-2 for the basic block diagram of this unit. The J/K flip-flop is triggered by the time base signal at terminal 6 and the gate ON condition at terminal 4. Zener diode CR401 and the internal circuitry of IC404D provide a level change of the time base signal which then activates this inverter-connected gate and provides one input to NAND gate IC404C. The counter gate ON level(0V at terminal 4) provides the second input through Q401 and inverter-connected IC407A and B. The output of IC404C is connected to the clock input of IC401 and triggers this flip-flop. The output of IC401 is at 1/3 the frequency of the selected time base signal and provides the trigger for the first preset decade.



Truth Table(Each FF)

t_n		$t_n + 1$
J	K	Q
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q}_n$

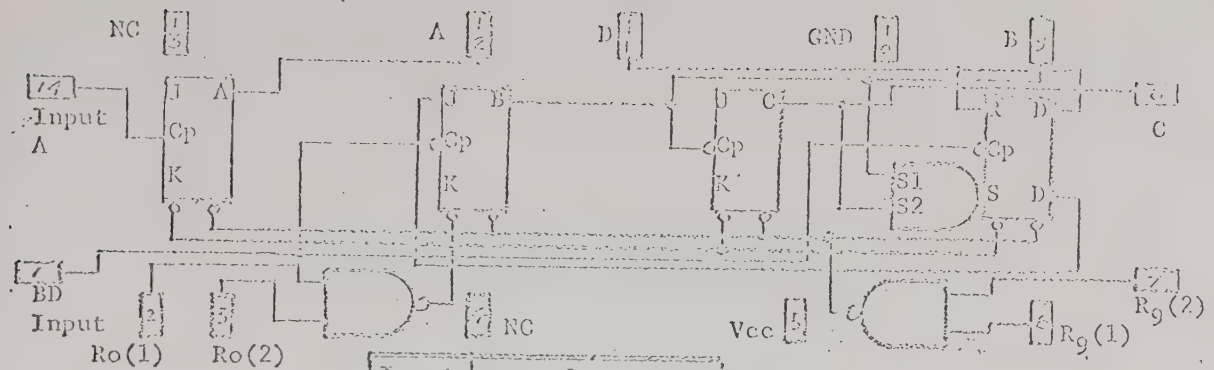
t_n=bit time before clock pulse
$t_n + 1$= bit time after clock pulse

(POSITIVE LOGIC. Low input to clear sets Q to logical 0 regardless of clock state)

Figure A1-2 Basic Logic Diagram - Dual J/K Flip-Flop

c. Harmonic Preset Decades. Two identical integrated-circuits are used. The basic block diagram and logic for these units are shown in figure A1-3. IC402 functions as the "units" and IC403 as the "tens" decade. Both decades provide a positive BCD(1-2-4-8) parallel output at terminals 1, 9, 8, and 11 respectively. The negative slope of the signal at terminal 11 of IC402, occuring at 1/10 the frequency of the input trigger from the scale-of-three binary, triggers the "tens" decade, IC403.

d. Stop Pulse Generator. The stop pulse for the counter gate is generated by the counter time base signal at terminal 6 at a time determined by the setting of the harmonic preset switches. This time is selectable from a minimum equal to the period of the time base signal(switches set to 00) to a maximum of 297 times this period(switches set to 99). In this manner the counter gate is extended to provide a direct reading of the frequency applied to the input jack of the transfer oscillator.



Input Count	Output D	C	B	A
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

BCD Count Sequence

Notes: Positive Logic. Output A connected to input BD for BCD Count.

Figure A1-3 Basic Block Diagram - Harmonic Preset Decades

The preset switch assemblies convert their decimal settings to a positive BCD (1-2-4-8) parallel output at terminals 8,7,10,9 and 15, 14,12, and 13. This logic provides a high level(5V) for one input of the NAND gates IC408 and IC409. The BCD outputs from the preset decades are inverted by IC405 and IC406 providing the second input for these gates. For a given harmonic number selected, the common output line of IC408 and IC409 will remain at a low level until that particular count is reached in the preset decades. The the common output line will be driven high, activating one input of the NAND gate IC407C. In coincidence, the time base signal activates the second input of this gate and a negative pulse is coupled to the base of Q402. This results in the generation of a positive stop pulse at terminal 5. This stop pulse terminates the counter gate, driving terminal 4 to a -6V level which inhibits further counting in the preset decades by deactivating NAND gate IC404C.
When the preset switches are positioned for 00, all switch terminals are open and the output of gates IC408 and IC409 are locked in the high level condition. Thus gate IC407C is continuously activated and the counter gate stop pulse will occur one time-base period after the start pulse for normal counter operation. With any other position, ;one or more of the switch lines are at 5V and the counter gate stop pulse is generated when the selected count is reached in the decades. See figure A1-4 for the preset switch detail.

e. Reset Circuit. A positive reset signal will be generated at terminal 1 by the counter circuits at a time after the stop pulse determined by the counter display interval. This reset pulse is inverted by IC404B to provide the negative pulse required to reset IC401 and inverted again by IC404A to provide the positive pulse required to reset IC402 and IC403.

f. Quad 2-Input NAND Gate. The schematic diagram for each gate of this unit is illustrated in figure A1-5. Component values shown are nominal.

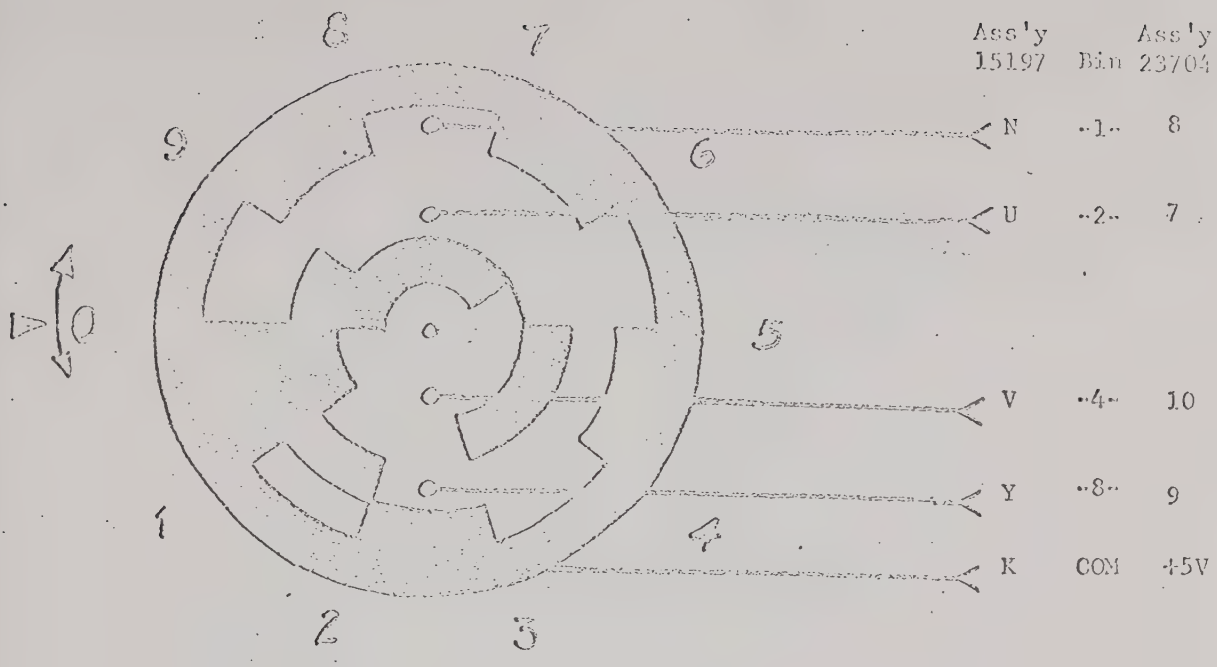


Figure A1-4 S2 Switch Detail

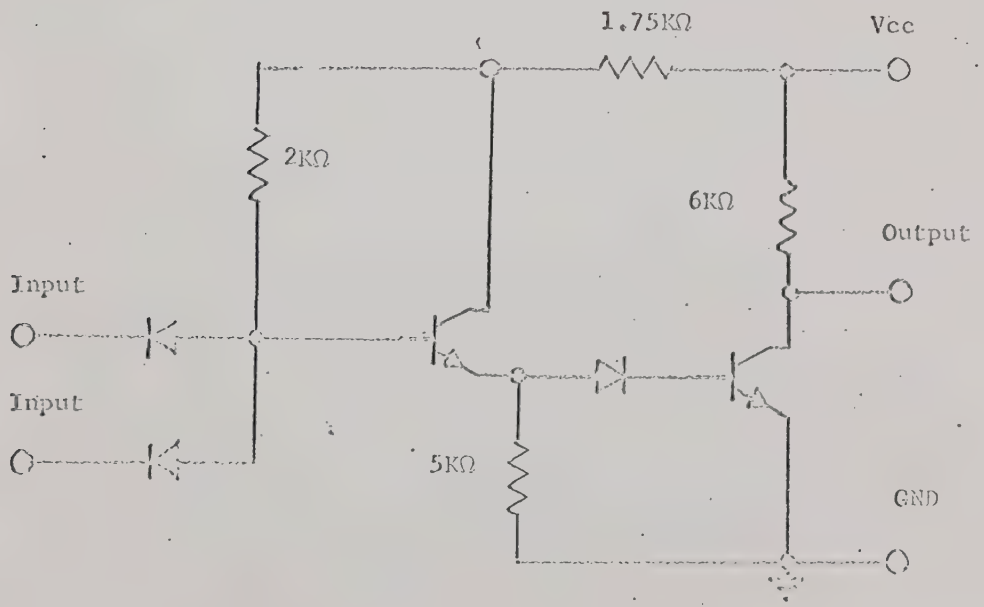


Figure A1-5 Schematic Diagram - Quad 2-INPUT NAND Gate

A2.1 Overall Functional Description. The model 1297 is a wide range(50MHz-26GHz) transfer oscillator plug-in unit designed for use with the 1017,1018 and 1037, 1038 series of SD counter-timers. It is similiar to the model 1292 but uses an additional preset switch(to extend the setting of harmonic numbers to 199) and requires an external mixer assembly. In operation with an external mixer, the VHF front panel connector supplies the internal oscillator(50MHz-150MHz) signal and the VIDEO connector accepts the resulting beat from the external mixer. The transfer oscillator technique is essentially a means of comparing harmonics of a fundamental(known) frequency with an unknown high frequency. The basic technique is illustrated in the basic block diagram of the 1297 illustrated in figure A2.1

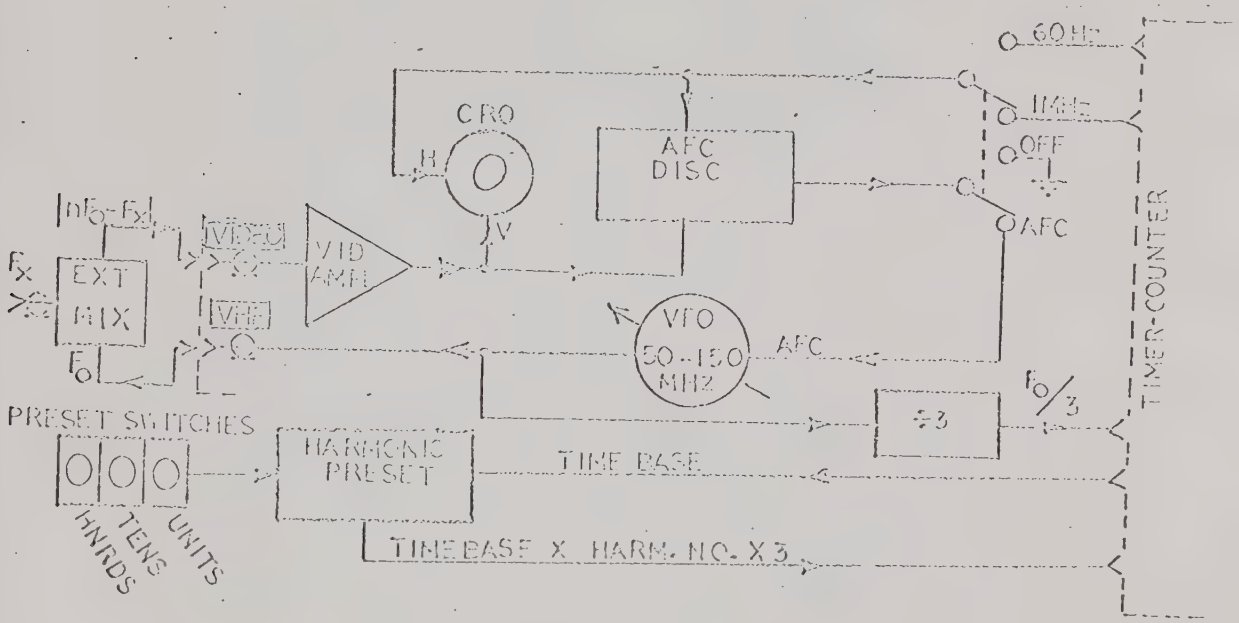


Figure A2.1 Basic Block Diagram - Model 1297 Transfer Oscillator

When making a measurement, the fundamental is adjusted to the point where one of its harmonics has the same frequency as the input signal. This is done by beating harmonics against the input signal in a mixer and varying the fundamental frequency until the difference frequency, as observed on the built-in oscilloscope, is zero. To enable the counter to read out the unknown frequency, the fundamental is multiplied by the harmonic number using the front panel harmonic preset switches which eliminate tedious manual calculations. The appropriate harmonic number will automatically expand the counting period of the counter to give a direct presentation of the input frequency in the readout of the counter. To bring the VFO within the counter frequency range, the VFO frequency is divided by 3 before application to the counter input. This is compensated for by providing a fixed multiplication of time base by a factor of 3 in the harmonic preset circuits.

The transfer oscillator is also provided with a phase lock mode to synchronize the transfer oscillator with the input signal. Any tendency toward frequency change in either the input signal or the transfer oscillator is immediately compensated for by changing the transfer oscillator frequency to maintain a precise one-MHz beat frequency with the input signal.

A2.2 Specifications. Specifications for the model 1297 are summarized below:

Frequency range	50MHz to 26GHz(with ext. mixers)
Input signals	Continuous fixed frequency, FM, pulsed RF
Accuracy	±stability ±resolution of measurement of TO fundamental
Stability	Same as 1MHz reference from basic counter in AFC mode
Resolution	±1 count
AFC lock on range	±0.25% of input frequency
Phase lock on range	±0.01% of input frequency
Local oscillator output	35 mW min., 50-150MHz
Output(to counter)	100 mV RMS
Video Ampl. Sensitivity	100 µV
Video Ampl. Input Resistance	470 Ω
Video Ampl. Output	0.5V PP min.

Controls:	
Fundamental signal dial	50MHz to 150MHz
Harmonic preset	001 to 199
Zero beat indicator	Self-contained oscilloscope
AFC switch	ON-OFF control
Vernier control	For fine tuning

Power	10 W(from basic counter)
Enviornment	0° to +55°C ambient
Weight	12 lbs(5.3 kg) net; 16 lbs(7.2 kg) shipping

Recommended external mixer	HP P932A(to 18GHz)

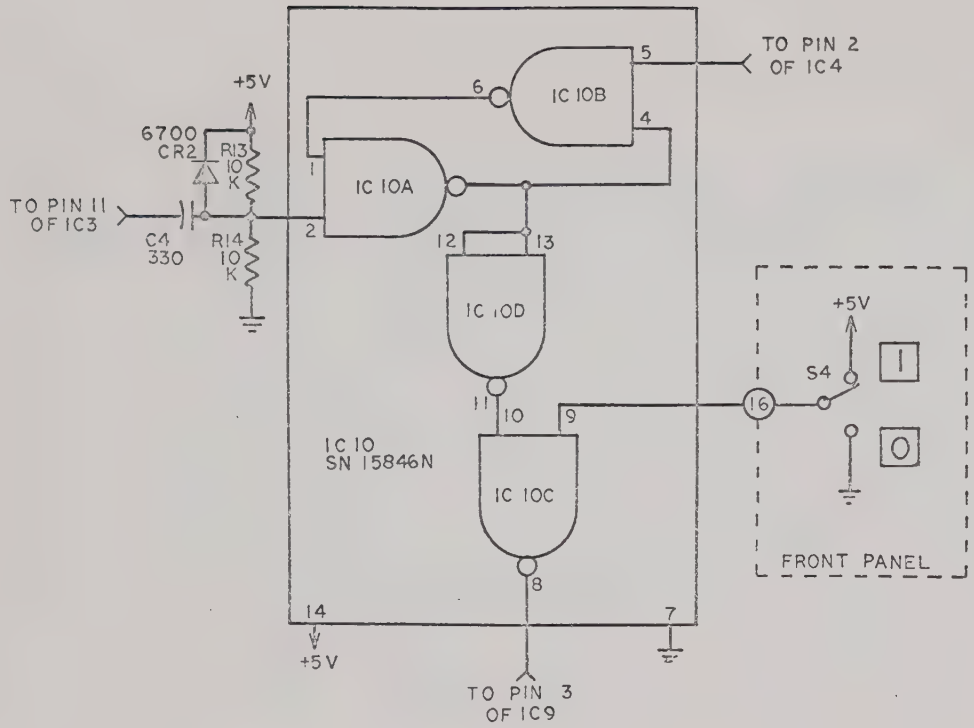
A2.3 Functional Unit Description. The model 1297 is basically a model 1292 with the internal mixer removed and an additional preset switch. Description of the various functional units is therefore essentially the same as that given in the instruction manual for the 1292 and will not be repeated here. The major circuit change involves the addition of the "hundreds" preset switch and binary and is discussed below.

a. "Hundreds" Preset Switch and Binary. The harmonic preset assembly(S25202) used in the model 1297 is identical to assembly 23704 used in the model 1292 except that the circuit of figure A2.2is included in the model 1297 assembly. This added circuit consists of binary-connected gate IC10 and front panel switch S4. Gates IC10A and IC10B form a bistable circuit that is triggered from the output of the "tens" harmonic preset decade and reset by a negative pulse from IC404B. The "0" or OFF state of this binary(low at output of IC10A and high at output of IC10B) produces a high level at the output of IC10C when switch S4 is set in the "0" position. Since the output of IC10C is connected to the common line of the gates for the "units" and "tens" preset decades, this high level permits a stop pulse to be generated for the counter gate for harmonic numbers 00 to 99. When S4 is set to the "1" position this output line is driven low and will remain low inhibiting the generation of a stop pulse until a trigger is received from the "tens" preset decade. C4 and CR2 allow only the negative slope of the output from the "tens" decade to trigger IC10A and this negative slope occurs at 1/100 of the frequency of the input to the "units" decade. Thus the output line will go high only after at least 100 pulses have entered the "units"decade plus whatever setting was present on switches S2 and S3.
A portion of the harmonic preset PC board assembly, S25202, is illustrated in figure A2.2 to indicate location of parts.

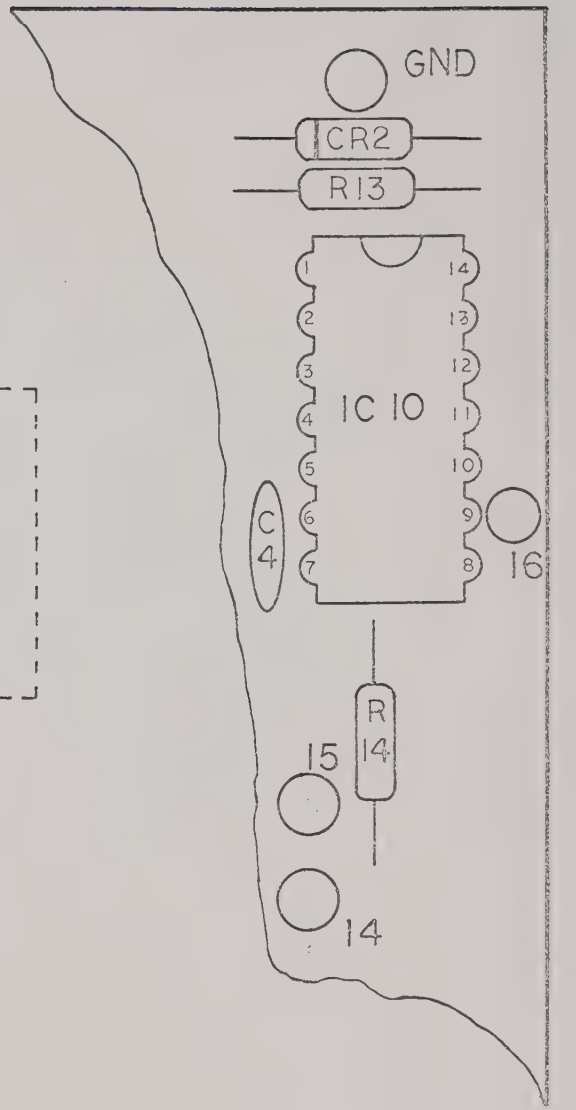
A2.4 Parts Lists . Table A2.1 lists those parts for the harmonic preset PC assembly 23704 and for the 1297 transfer oscillator not previously listed in the instruction manual for the 1292.

TABLE A2.1
MAINTENANCE PARTS LIST

REF DESIG	NAME AND DESCRIPTION	SD PART NUMBER
	HARMONIC PRESET SWITCH ASSEMBLY - 16034	
S2	Switch, digit; Chicago Dynamic Industries MTTSB-P-10	S0139
S3	Same as S2	S0139
	HARMONIC PRESET PC ASSEMBLY - S25202(Add following parts to list for assembly 23704)	
C404	Capacitor; 330 pF	C0540
CR402	Diode; 6700	6700
IC410	Same as IC404	19716
R413	Same as R403	R0766
R414	Same as R403	R0766
	HARMONIC PRESET SWITCH ASSEMBLY - (Model 1297)(Add following parts to list for assembly 16034)	
S4	Switch, Slide; Chicago Dynamic Industries SS50[illegible]DT	S0110

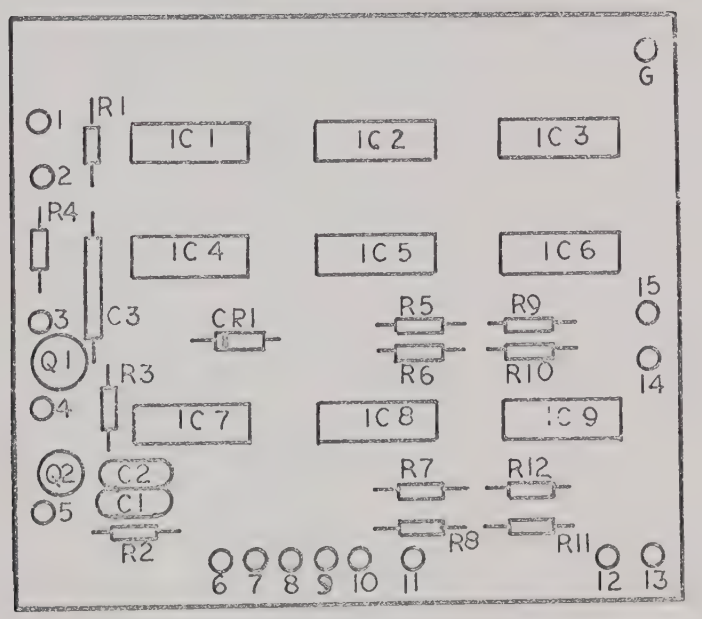


HUNDREDS
BINARY
AND
PRESET SWITCH



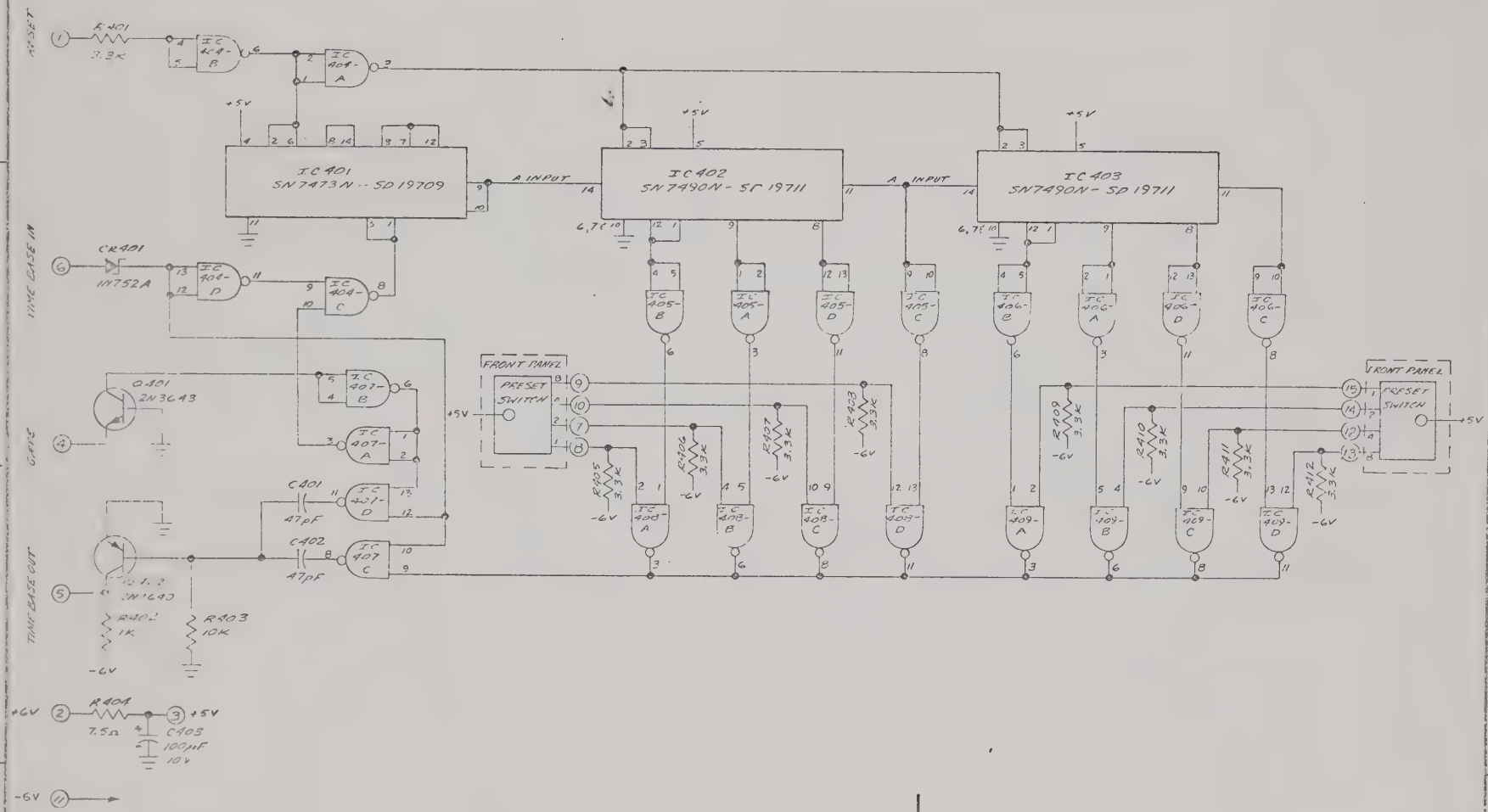
P/O PC BOARD ASS'Y
S25202

MODEL 1297
"0-1" HARMONIC PRESET



HARMONIC PRESET ASS'Y 23704

REVISIONS					
ISSUE	DESCRIPTION	SER. NO.	ECO NO.	DATE	APP. BY
A	NEW DWG	~	5621		

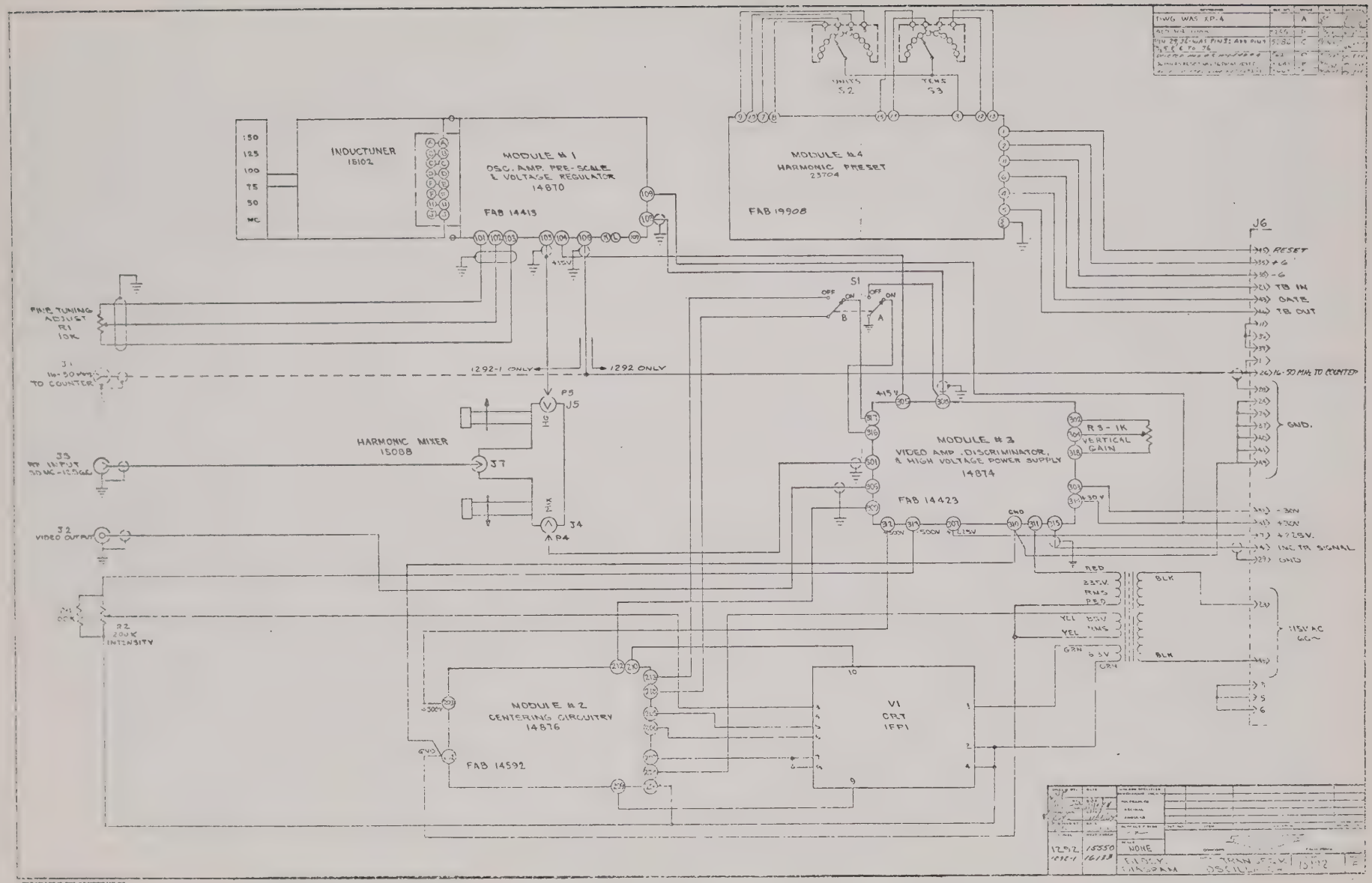


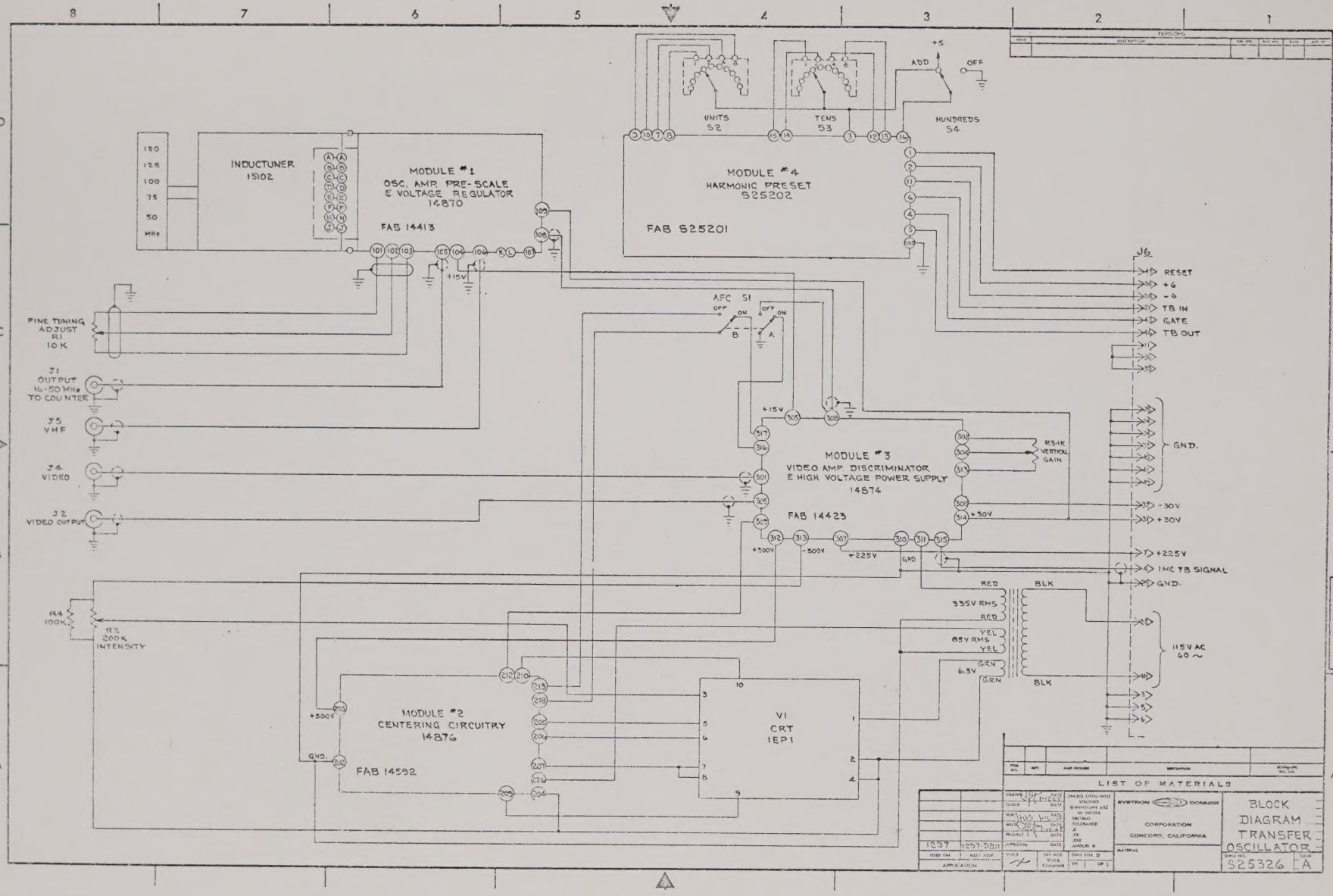
1. ALL GATES, IC 404, 5, 6, 7, 8 & 9 ARE SN 15846 N - SD 19716
   PIN 7 IS GROUND
   PIN 5 IS +5 V

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION	SCHEMATIC REF. NO.

LIST OF MATERIALS

		DRAWN K.WYMAN 5-10-67	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCE X .XX .XXX ANGLES ±	SYSTRON DONNER CORPORATION CONCORD, CALIFORNIA	SCHEMATIC HARMONIC PRESET
		CHECK R.B. 5/24/67			
		ELECT.			
		MECH. R.B. 5/24/67			
		PROJECT NEV 5-24-67			
1292	23704	APPROVAL		MATERIAL ~	DWG NO. 23705 ISSUE A
USED ON	NEXT ASSY	SCALE ~	DO NOT SCALE DRAWING	DWG SIZE C SH 1 OF 1	
APPLICATION					


INDUCTUNER
15102
MODULE # 1
OSC. AMP. PRE-SCALE
& VOLTAGE REGULATOR
14870
FAB 14413
MODULE # 4
HARMONIC PRESET
23704
FAB 19908
MODULE # 3
VIDEO AMP. DISCRIMINATOR,
& HIGH VOLTAGE POWER SUPPLY
14874
FAB 14423
MODULE # 2
CENTERING CIRCUITRY
14876
FAB 14592
HARMONIC MIXER
15088
VI
CRT
1FP1
FINE TUNING
ADJUST
R1
10K
R2
20K
INTENSITY
R3 - 1K
VERTICAL
GAIN
J1
1292-1 ONLY
1292 ONLY
J2
VIDEO OUTPUT
J3
RF INPUT
J4
J5
J6
J7
S1
RESET
+G
-G
TB IN
GATE
TB OUT
GND.
-30V
+13V
+12.5V.
INC TR SIGNAL
115V AC
60~
RED
BLK
YEL
GRN
6.3V
12.92
16550
16133
NONE


INDUCTUNER
15102
150
125
100
75
50
MHz
MODULE #1
OSC. AMP. PRE-SCALE
& VOLTAGE REGULATOR
14870
FAB 14413
MODULE #4
HARMONIC PRESET
S25202
FAB S25201
UNITS
S2
TENS
S3
HUNDREDS
S4
+5
ADD
OFF
J6
RESET
+6
-6
TB IN
GATE
TB OUT
AFC S1
OFF
ON
B
A
FINE TUNING
ADJUST
R1
10K
J1
OUTPUT
10-50 MHz
TO COUNTER
J5
VHF
J4
VIDEO
J2
VIDEO OUTPUT
+15V
MODULE #3
VIDEO AMP. DISCRIMINATOR
& HIGH VOLTAGE POWER SUPPLY
14874
FAB 14423
R34K
VERTICAL
GAIN
GND.
-30V
+30V
+225V
INC TB SIGNAL
+300V
-500V
GND
RED
BLK
335V RMS
YEL
85V RMS
GRN
6.3V
115V AC
60 ~
R4
100K
R3
200K
INTENSITY
MODULE #2
CENTERING CIRCUITRY
14876
FAB 14592
VI
CRT
1EP1
LIST OF MATERIALS
BLOCK
DIAGRAM
TRANSFER
OSCILLATOR
CONCORD, CALIFORNIA
S25326
A

WARRANTY

Systron-Donner instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes, except as they are warranted by tube manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense during such period and which has not been subjected to misuse, neglect, improper installations, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

RECEIVING INSPECTION

Every Systron Donner instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

REPAIRS

Whenever a Systron-Donner instrument requires service, the nearest Systron-Donner representative should be contacted; all representatives will provide immediate service or arrange factory returns when necessary.

Please specify both model and serial number in all correspondence concerning Systron-Donner instruments. Address all inquiries on operation or applications to your nearest sales representative or Sales Manager, Instruments, Systron-Donner Corporation, 888 Galindo Street, Concord, California.

MP MASTER
MA34155